IRI/T130

FAO Fisheries Technical Paper No. 130
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FIRI/T130
Cultivated Species Catalogue

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A CATALOGUE OF CULTIVATED AQUATIC ORGANISMS

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
ROME, 1974

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CART	Renseignements sur les pêcheries et les ressources de certains pays et régions (FID/S)

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SAST	Datos relativos a ciertas especies y poblaciones
MAST	Sinopsis sobre métodos y materias
OT	Sinopsis sobre oceanografía
IT	Sinopsis sobre limnología
	y
CART	Información sobre los recursos acuáticos vivos de algunos países y regiones (FID/S)

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RE	Indexed lists of experts and institutions drawn from Registers maintained by the Fishery Resources Division
CB	Lists of periodicals, special sections of "Aquatic Sciences and Fisheries Abstracts (ASFA)," special bibliographies and papers concerning documentation problems
MFS	Provisional editions of "FAO Manuals in Fisheries Science"
WAFR	Provisional reviews of fisheries resources and their level of exploitation, by regions or by species groups, within the World Appraisal of Fishery Resources system

Some documents also have another identification, if, for example, they have been contributed to a meeting for which papers have been numbered according to another system.

Des catégories spéciales de documents techniques sont identifiées à l'aide des symboles suivants:

RE	Listes indexées d'experts et institutions tirées des registres tenus à jour par la Division des ressources halieutiques
CB	Listes de périodiques, des sections spéciales de la « Aquatic Sciences and Fisheries Abstracts (ASFA)», des bibliographies particulières et des articles sur les problèmes de documentation
MFS	Editions provisoires des «Manuels FAO de science halieutique»
WAFR	Synthèses provisoires des ressources halieutiques et leur niveau d'exploitation, préparées, par régions ou groupes d'espèces, dans le cadre du Programme mondial pour l'évaluation des ressources halieutiques

Certains documents portent parfois d'autres numéros d'identification, par exemple s'ils ont été préparés pour une réunion dont les documents ont été marqués à l'aide d'un autre système.

Grupos especiales de documentos técnicos se identifican por las siglas siguientes:

RE	Listas índices de expertos y de instituciones tomadas de los registros que se llevan en la Dirección de Recursos Pesqueros
CB	Listas de periódicos, secciones especiales de la «Aquatic Sciences and Fisheries Abstracts (ASFA)», bibliografías especiales y trabajos relativos a los problemas de documentación
MFS	Ediciones provisionales de los «Manuales de la FAO de Ciencias Pesqueras»
WAFR	Reseñas provisionales de los recursos pesqueros y de su estado actual de explotación, por regiones o por grupos de especies, en el marco del sistema mundial para la evaluación de los recursos pesqueros

Algunos documentos tienen también otra identificación si, por ejemplo, son contribuciones a una reunión cuyos documentos han sido marcados con arreglo a otros sistemas.

CATALOGUE

OF

CULTIVATED AQUATIC ORGANISMS

by

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Central Inland Fisheries Research Institute
Barrackpore, India

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
Rome, March 1974

PREPARATION OF THIS DOCUMENT

This paper was prepared by Dr. V.G. Jhingran and Dr. V. Gopalakrishnan of the Central Inland Fishery Research Institute, Barrackpore (West Bengal), India, at the request of FAO. The first draft, prepared in 1970, was expanded and partly updated with the assistance of the staff of the Fishery Resources and Environment Division of the FAO Department of Fisheries. It is a contribution to the Division's programme of collection, review and dissemination of aquaculture information.

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FOREWORD

With increasing interest in the development of aquaculture, the search for suitable species and species-combinations for culture has become particularly important. International exchange of species for experimental and commercial scale operations is also increasing rapidly and FAO is often called upon to provide information required by aquaculturists and fishery development planners to select suitable organisms. Dr. V.G. Jhingran and Dr. V. Gopalakrishnan were therefore requested to prepare this catalogue of cultivated organisms, to serve as a source of reference on the subject.

It is recognized that a catalogue of this nature can hardly ever be complete, as experimental work on many local species is underway in different countries constantly adding to the list of cultivated organisms. The distribution of many of the species included in this catalogue may also have become wider than indicated as a result of introductions and transplantations. Although efforts have been made by the authors and FAO to make it as exhaustive as possible, the text may be found to be incomplete in this respect as well. Readers are requested to point out any omissions they identify and provide available additional data for use in future revisions of the catalogue.

T.V.R. Pillay
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PREFACE

Aquaculture in fresh, brackish and salt water environments is expanding rapidly and the selection of suitable species for culture forms a basic decision to be made by aquaculturists. While opinions differ as to whether indigenous species only should be used, or proven species, even if exotic, should be also used to obtain increased production in a short period of time, relevant information on cultivated species is undoubtedly essential for rational decision-making.

The purpose of this document is to furnish a list of the cultivated organisms in different regions of the world, with notes on available essential biological data, in order to assist aquaculturists in this task. The organisms have been listed under different systematic groups for the sake of convenience and, within each group, the species are presented alphabetically. Along with the scientific name of each species, the common name (wherever available) and the name of the family to which it belongs have been mentioned. No attempt has been made to go into taxonomic details of the organisms. A general indication of the area where the organism concerned is endemic along with an idea of its geographical distribution, has also been given wherever possible. Available data on the more important aspects of the biology of the species related to its cultivation are summarized. In order to save space telegraphic style has been adopted for the descriptions.

Most of the compilation was done in the libraries of the Central Inland Fisheries Research Institute, Barrackpore, Zoological Survey of India, Calcutta and the National Library, Calcutta. In a few cases, useful information has been gathered through correspondence from workers in certain specialized fields. An attempt has been made here to include all species or genera which have been cultivated in fresh, brackish and sea waters with some measure of success. In this respect, the authors had to make a distinction between organisms which are 'cultured' under laboratory conditions and those that are 'cultivated' in cisterns, tanks, ponds, etc. For the purpose of comprehensiveness, the organisms, mainly fishes, which are first spawned under artificial conditions, and then grown in hatcheries or tanks, troughs etc., but whose young or juveniles are released into open waters for stocking, have been included in this list. However, many diatoms, algae, protozoans etc., cultures of which are maintained and propagated under laboratory conditions only have not been included as they fall outside the scope of the term 'cultivated organisms'. It would perhaps be appreciated that every organism, specially fish, which may have been cultivated very rarely cannot possibly be included in this list and if this were to be done, probably many more species of fishes in the world would have to be listed here. In a general sense, the list includes only those organisms which are of use for food, sport, biological control and are cultivated to serve for forage, bait, etc. Purely aquarium fishes have been excluded, unless they are cultivated for one or more of the above-stated purposes.

The authors wish to record here their appreciation of the assistance given by Mr. H.A. Khan, Mr. M.V. Gupta and Dr. C.S. Singh in the collection of data concerning specific groups. Dr. Z.H. Shehadeh of the FAO Department of Fisheries provided information on a number of fish species cultivated in the United States and Japan and Mr. M. Pedini on species cultured in Latin America. The authors are also grateful to the Indian Council of Agricultural Research for permitting acceptance of this assignment and to the Zoological Survey of India and National Library, Calcutta, for the consultation facilities offered.

V.G. Jhingran

V. Gopalakrishnan

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1. CLASSIFIED LIST OF CULTIVATED AQUATIC ORGANISMS

AQUATIC PLANTS

ALGAE

Class Chlorophyceae
  Order Chlorococcales
    Family Cocystacea

Chlorella ellipsoidea Gerneck
Chlorella pyrenoidosa Chick
Chlorella vulgaris Beijerinck

    Family Scenedesmaceae

Scenedesmus obliquus (Turpin) Kuetz

  Order Ulotrichales
    Family Ulvacea

Enteromorpha compressa (Linnaeus) Greville

    Family Monostromataceae

Monostroma crassissimum Iwanoto
Monostroma grevillei (Thuret) Wittrock
Monostroma latissimum (Kutzing) Wittrock
Monostroma nitidum Wittrock
Monostroma tubiliforme Iwanoto

    Family Chladophoraceae

Cladophora sp.
Chaetomorpha antennica Kuetz
Chaetomorpha crassa Kuetz

  Order Siphonales
    Family Caulerpaceae

Caulerpa racemosa (Forskål) Weber-van-Bosse

Class Bacillariophyceae
  Order Centrales
    Family Skeletonemaceae

Skeletonema costatum (Greville) Cleve

    Family Coscinodiscaceae

Cyclotella sp.

    Family Thalassiosiraceae

Thalassiosira sp.

  Order Pennales
    Family Phaeodactylaceae

Phaeodactylum tricornutum Bohlin

    Family Nitzschiaceae

Nitzschia closterium (Ehrenberg) W. Smith

Class Dinophyceae
Sub-class Dinokontae
Order Dinoflagellata
Family Gymnodiniaceae

Gymnodinium brevis Davis

Family Glenodiniaceae

Hemidinium sp.

Class Phaeophyceae
Order Laminariales
Family Laminariaceae

Laminaria japonica Areshong
Laminaria ochotenses Miyabe

Family Lessoniaceae

Undaria pinnatifida (Harvey) Suringar

Class Rhodophyceae
Order Bangiales
Family Bangiaceae

Porphyra angusta Okamura and Ueda
forma sanrikuensis Kurogi
Porphyra kuniedai Kurogi
Porphyra okamurai Ueda
Porphyra pseudolinearis Ueda
Porphyra tenera Kjellman
Porphyra umbilicalis (Linnaeus) Kuetz
Porphyra variegata (Kjellman) Hudson
Porphyra vulgaris J. Agardh
Syn. P. laciniata J. Agardh
Porphyra yezoensis Ueda

Order Gelidiales
Family Gelidiaceae

Gelidium amansii Lamour

Order Cryptonemiales
Family Endocladiaceae

Gloiopeltis coliformis Harvey
Gloiopeltis furcata (Postels and Ruprecht)
J. Agardh

Order Gigartinales
Family Solieriaceae

Eucheuma edule J. Agardh
Eucheuma muricatum (Gmelin) Weber-van-Bosse
Syn. E. Spinosum (Linnaeus) J. Agardh

Family Gracilariaceae

Gracilaria verrucosa (Hudson) Papenfuss
Gracilaria sp.

Family Phyllophoraceae

Ahnfeltia plicata (Hudson)
Fries var. tobuchiensis Kanno and Matsub

Class Myxophyceae
Order Chroococcales
Family Chroococcaceae

Coccochloris (*Microcystis*) *aeruginosa* (Nägeli) Drouet and Daily

Order Nostocales
Family Oscillatoriaceae

Spirulina maxima (Seth and Gardner)

ANGIOSPERMS

Dicotyledons

Family Nymphaeaceae

Nelumbium speciosum Willdenow
Nymphaea lotus Linnaeus
Nymphaea stellata Willdenow

Family Onagrariaceae

Irapa bicornis Linnaeus
Irapa bispinosa Roxburgh
Irapa natans Linnaeus

Family Convolvulaceae

Ipomoea aquaticia Forskål

Family Hydrophyllaceae

Hydrolea zeylanica (Linnaeus) Vahl

Monocotyledons

Family Lemnaceae

Lemna sp.
Wolffia sp.

Family Cyperaceae

Eleocharis planktaginea Robert Brown
Eleocharis tuberosa Schutters

Family Graminae

Oryza sativa Linnaeus (Aquatic varieties)

AQUATIC ANIMALS

PHYLUM PORIFERA

Class Demospongiae
Order Monaxonida
Family Spongillidae

Spongilla spp.

Order Ceratina
Family Spongiidae

Euspongia officinalis adriatica (O. Schmidt)
Euspongia officinalis lamella Schulze
Euspongia officinalis mollissima (O. Schmidt)

Hippiospongia canaliculata flabellum Lendenfeld
Hippiospongia grossypina (Duchassaing and Michelotti)
Hippiospongia lachne de Laubanfels
Spongia agaricina corlosia (Duchassaing and Michelotti)
Spongia barbara Duchassaing and Michelotti
Spongia dura Hyatt
Spongia graminea Hyatt
Spongia obliqua Duchassaing and Michelotti

PHYLUM ROTIFERA

Order Ploima
Sub-order Loricata
Family Brachionidae

Brachionus calyciflorus Pallas
Brachionus plicatilis Müller
Brachionus rubens Ehrenberg

PHYLUM ANNELIDA

Class Chaetopoda
Order Polychaeta
Sub-order Capitelliformia
Family Arenicolidae

Arenicola cristata (Stimpson)

Order Oligochaeta
Sub-order Limicolae
Family Enchytraeidae

Enchytraeus albidus ?

PHYLUM ARTHROPODA

Class Crustacea
Order Branchiopoda
Sub-order Phyllopoda
Tribe Anostraca
Family Artemiidae

Artemia salina (Linnaeus)

Sub-order Cladocera
Family Chydoridae

Chydorus sphaericus (Müller)

Family Daphnidae

Daphnia carinata King
Daphnia magna Straus
Daphnia pulex Leydig
Daphnia spp.
Moina macrocopa Straus
Moina spp.
Simocephalus sp.

Family Polyphemidae

Polyphemus pediculus (Linnaeus)

Order Amphipoda
Sub-order Amphipoda genuina
Family Gammaridae

Gammarus sp.

Order Decapoda
Sub-order Natantia
Family Penaeidae

Metapenaeus affinis (H. Milne Edwards)
Metapenaeus barbata De Haan
Metapenaeus bennattae Racek and Dall
Metapenaeus brevicornis (H. Milne Edwards)
Metapenaeus burkonroadi Kubo
Metapenaeus dobsoni (Miers)
Metapenaeus elegans De Man
Metapenaeus ensis (De Haan)
Metapenaeus intermedius (Kishinouye)
Metapenaeus joyneri (Miers)
Metapenaeus lysianassa (De Man)
Metapenaeus monoceros (Fabricius)
Metapenaeus mutatus (Lanchester)
Metapenaeus spinulatus Kubo
Parapeneopsis tenella (Bata)
Penaeus aztecus Ives
Penaeus canaliculatus Olivier
Penaeus duorarum Burkenroad
Penaeus indicus H. Milne Edwards
Penaeus indicus longirostris (De Man)
Penaeus japonicus Bate
Penaeus latisulcatus Kishinouye
Penaeus merguiensis De Man
Penaeus monodon Fabricius
Penaeus orientalis Kishinouye
Penaeus semisulcatus (De Man)
Penaeus setiferus (Linnaeus)
Penaeus teraoi Kubo
Trachypenaeus (*Trachysalambrica*) *similis* (Smith)
Trachypenaeus spp.
Xiphopenaeus kryeri (Heller)

Family Atydidae

Caridina gracilirostris De Man

Family Palaemonidae

Macrobrachium acanthurus (Wiegmann)
Macrobrachium americanum Bate
Macrobrachium carcinus (Linnaeus)
Macrobrachium idae (Heller)
Macrobrachium lanchesteri (De Man)
Macrobrachium malcolmsonii (H. Milne Edwards)
Macrobrachium rosenbergii (De Man)
Macrobrachium rude (Heller)
Macrobrachium sintangense (De Man)
Palaemon paucidens De Haan
Palaemon styliferus H. Milne Edwards
Palaemonetes kadiakensis Rathbun
Palaemonetes sp.

Family Crangonidae

Crangon crangon (Linnaeus)

Sub-order Reptantia
Family Palinuridae

Jasus edwardsii (Hutton)
Panulirus argus (Latreille)
Panulirus japonicus (De Haan)

Family Nephropsidae

Homarus americanus H. Milne Edwards
Homarus vulgaris H. Milne Edwards
Homarus sp.

Family Astacidae

Astacus sp.
Orconectes propinquus (Girard)
Pacifastacus leniusculus (Dana)
Procambarus blandingii (Harlan)
Procambarus clarkii (Girard)

Section Brachyura
Family Grapsidae

Varuna litterata (Fabricius)

Family Xanthidae

Panopeus herbstii H. Milne Edwards

Family Scyllidae

Scylla serrata (Forskål)

Family Portunidae

Neptunus pelagicus (Linnaeus)

Class Insecta
Order Diptera
Family Chironomidae

Chironomus pulcher Wiedeman
Chironomus sp.

PHYLUM MOLLUSCA

Class Lamellibranchiata
Order Filibranchiata
Family Anomiidae

Placuna placenta (Linnaeus)
Syn. *Placenta placenta* (Linnaeus)

Family Arcidae

Anadara broughtonii (Schrenk)
Anadara granosa Linnaeus
Anadara granosa bisinensis Schrenk and Reinhart
Anadara inflata Reeve
Anadara subcrenata (Lischke)
Anadara spp.
Arca granosa Lamarck
Arca sp.

Family Mytilidae

Mytilus crassitesta Lisk
Mytilus edulis Linnaeus
Mytilus galloprovincialis Lamarck
Mytilus smaragdinus Chemnitz
Syn. Mytilus viridis Linnaeus
Mytilus sp.

Order Pseudolamellibranchiata
Family Aviculidae

Perna perna Linnaeus
Syn. Isognomon perna (Linnaeus)

Family Pteriidae

Pinctada emarginata ?
Pinctada fucata (Gould)
Pinctada margaritifera (Linnaeus)
Pinctada martensii (Dunker)
Pinctada maxima (Jameson)
Pinctada vulgaris Schum
Pteria penguin (Röding)

Family Ostreidae

Crassostrea angulata (Lamarck)
Crassostrea commercialis Iredale and Roughley
Crassostrea cucullata Born
Crassostrea gasar Adanson
Crassostrea gigas (Thunberg)
Crassostrea glomerata Gould
Crassostrea gryphoides (Schlotheim)
Crassostrea margaritacea (Lamarck)
Crassostrea rhizophorae Guilding
Crassostrea rivularis (Gould)
Crassostrea virginica (Gmelin)
Crassostrea vitrefacta Sow
Ostrea denselamellosa Lischke
Ostrea edulis Linnaeus
Ostrea iredalei Faustino
Ostrea lurida (Carpenter)
Ostrea madrasensis Preston
Syn. Ostrea gryphoides cuttackensis
Ostrea malabonensis Faustino
Ostrea palmipes Sowarby
Ostrea taurica Krynicki
Ostrea tulipa Lamarck
Pcynodonta numisma Lamarck

Family Pectenidae

Pecten lagueatus Sowarby
Pecten yessoensis ?

Order Eulamellibranchiata
Family Unionidae

Cristaria plicata spatiosa (Clessin)
Hyriopsis schlegelli (Martens)
Lampsilis claiborneensis Lea

Family Mactridae

Mactra sulcataria Deshayes

Family Mercenaridae

Mercenaria mercenaria (Linnaeus)

Family Veneridae

Meretrix casta (Chemnitz)
Meretrix lamarckii Deshayes
Meretrix lusoria (Gmelin)
Meretrix meretrix (Linnaeus)
Paphia phillipinarum (A. Adams and Reeve)
Protothaca staminea Conrad
Saxidomus giganteus (Deshayes)
Tapes decussatus (Linnaeus)
Tapes semidecussata Reeve
Syn. Venerupis semidecussata (Reeve)
Venerupis japonica Reeve
Venerupis variegata Sowarby
Syn. Tapes variegata (Sowarby)
Venus verrucosa Linnaeus

Family Myidae

Mya arenaria Linnaeus

Class Gastropoda
Order Streptoneura
Sub-order Aspidobranchiata
Family Haliotidae

Haliotis discus hannai Ino

Sub-order Pectinibranchiata
Family Muricidae

Murex trunculus Linnaeus

Class Cephalopoda
Order Dibranchiata
Sub-order Decapoda
Family Loliginidae

Loligo bleekeri Keferstein

Family Sepiidae

Sepia esculenta Hoyle

Sub-order Octopoda
Family Octopodidae

Octopus vulgaris Cuvier

PHYLUM ECHINODERMATA

Class Holothuroides
Order Actinopoda
Family Holothuridae

Holothuria spp.

PHYLUM VERTEBRATA

Sub-phylum Craniata
Class Teleostomi
Sub-class Crossopterygii
Family Polypteridae

Polypterus senegalus Cuvier

Sub-class Actinopterygii
Family Acipenseridae

Acipenser baeri Brandt
Acipenser güldenstaedti Brandt
Acipenser ruthenus Linnaeus
Acipenser stellatus Pallas

Family Polyodontidae

Polyodon spathula Walbaum

Family Elopidae

Elops hawaiensis Regan
Elops machnata (Forskål)
Elops saurus Linnaeus

Family Megalopidae

Megalops cyprinoides (Broussonet)

Family Clupeidae

Alosa finta (Cuvier)
Alosa sapidissima (Wilson)
Clupea harengus Linnaeus
Clupea pallasi Valenciennes
Hilsa ilisha (Hamilton)

Family Chanidae

Chanos chanos (Forskål)

Family Arapaimidae

Arapaima gigas Cuvier

Family Heterotidae

Heterotis niloticus Cuvier

Family Gymnarchidae

Gymnarchus niloticus Cuvier

Family Salmonidae

Hucho hucho (Linnaeus)
Oncorhynchus gorbuscha (Walbaum)
Oncorhynchus keta (Walbaum)
Oncorhynchus kisutch (Walbaum)
Oncorhynchus nerka (Walbaum)
Oncorhynchus rhodurus (Jordan and McGregor)
Oncorhynchus tshawytscha (Walbaum)
Salmo aguabonita Jordan
Salmo clarki Richardson
Salmo gairdneri Richardson
Salmo letnica Karamen
Salmo salar Linnaeus
Salmo trutta Linnaeus

Salmo trutta trutta Linnaeus
Salvelinus fontinalis (Mitchill)
Salvelinus malma (Walbaum)
Salvelinus namaycush (Walbaum)
Salvelinus sp.

Family Plecoglossidae

Plecoglossus altivelis Temminck and Schlegel

Family Coregonidae

Coregonus albula (Linnaeus)
Coregonus clupeaformis (Mitchill)
Coregonus lavaretus (Linnaeus)
Coregonus lavaretus maraena Bloch
Coregonus nasus (Pallas)
Coregonus peled (Gmelin)

Family Thymallidae

Thymallus arcticus (Pallas)
Thymallus thymallus (Linnaeus)

Family Osmeridae

Hypomesus olidus (Pallas)

Family Anguillidae

Anguilla anguilla (Linnaeus)
Anguilla japonica Temminck and Schlegel

Family Characinidae

Alestes imberi Peters
Astyanax mexicanus (Filippi)
Syn. A. fasciatus mexicanus (?)
Brycon guatemalensis (Günther)
Brycon henni Eigenmann
Hepsetus odoë (Bloch)
Hydrocyon brevis Günther
Hydrocyon forskali Cuvier
Hydrocyon vittatus Castelnau
Myletes bidens Spix
Mylossoma sp.

Family Anostomidae

Leporinus copelandi Steindachner
Leporinus elongatus (Cuvier and Valenciennes)
Leporinus octofasciatus
Leporinus sp.
Prochilodus argenteus Spix
Prochilodus scrofa Steindachner
Prochilodus sp.

Family Citharinidae

Citharidium ansorgei Boulenger
Citharinus citharus Geoffroy
Citharinus congicus Boulenger
Citharinus gibbosus Boulenger
Distichodus fasciatus Boulenger
Distichodus maculatus Boulenger

Family Catostomidae

Catostomus commersonii (Lacépède)
Ictiobus bubalus (Rafinesque)
Ictiobus cyprinellus (Valenciennes)
Syn. Megastomatobus cyprinellus (Valenciennes)
Ictiobus niger (Rafinesque)

Family Cyprinidae

Abramis brama (Linnaeus)
Acrossocheilus hexagonolepis (McClelland)
Aristichthys nobilis (Richardson)
Barbus aureus (Cope)
Barbus caudovittatus Boulenger
Barbus grypus Heckel
Barbus holubi Steindachner
Barbus luteus Heckel
Barbus occidentalis Boulenger
Barbus paludinosus Peters
Barbus spharpeyi Günther
Barbus trimaculatus Peters
Barbus xanthopterus (Heckel)
Carassius auratus (Linnaeus)
Carassius auratus gibelio (Bloch)
Carassius carassius (Linnaeus)
Catla catla (Hamilton)
Chalcalburnus chalcoides (Güldenstaedt)
Cirrhina cirrhosa (Bloch)
Cirrhina molitorella (Cuvier and Valenciennes)
Cirrhina mrigala (Hamilton)
Cirrhina reba (Hamilton)
Ctenopharyngodon idellus (Cuvier and Valenciennes)
Cyprinus carpio (Linnaeus)
Hypophthalmichthys harmandi Sauvage
Hypophthalmichthys molitrix (Valenciennes)
Labeo bata (Hamilton)
Labeo calbasu (Hamilton)
Labeo collaris Nichols and Pope
Labeo coubie Rüppell
Labeo fimbriatus (Bloch)
Labeo gonius (Hamilton)
Labeo kontius (Jerdon)
Labeo lineatus Boulenger
Labeo rohita (Hamilton)
Labeo senegalensis (Cuvier and Valenciennes)
Leuciscus (Idus) idus (Linnaeus)
Matsya sinensis (Bleeker)
Megalobrama terminalis (Richardson)
Mylopharyngodon piceus (Richardson)
Syn. Mylopharyngodon aethiops (Basilewsky)
Notemigonus crysoleucas (Mitchill)
Osteochilus hasseltii (Cuvier and Valenciennes)
Osteochilus thomassi (Day)
Parabramis pekinensis (Basilewsky)
Phoxinus phoxinus (Linnaeus)
Pimephales notatus Rafinesque
Pimephales promelas Rafinesque
Puntius belinka (Bleeker)
Puntius carnaticus (Jerdon)

Puntius gonionotus (Bleeker)
Syn. Puntius javanicus (Bleeker)
Puntius orphoides (Cuvier and Valenciennes)
Puntius sarana (Hamilton)
Puntius schwanefeldii (Bleeker)
Rhinichthys atratulus Hermann
Rutilus frisii kutum (Kamensky)
Rutilus (Leuciscus) rutilus (Linnaeus)
Scardinius erythrophthalmus (Linnaeus)
Semotilus atromaculatus (Mitchill)
Squaliobarbus curriculus (Richardson)
Thynnichthys sandkhol (Sykes)
Tinca tinca (Linnaeus)
Tor tambroides (Bleeker)
Vimba vimba (Linnaeus)

Family Cobitidae

Misgurnus anguillicaudatus (Cantor)

Family Siluridae

Aegeniosus brevifilis Valenciennes
Parasilurus asotus (Linnaeus)
Silurus glanis Linnaeus
Wallago attu (Schneider)

Family Ictaluridae

Ictalurus catus (Linnaeus)
Ictalurus furcatus (Lesueur)
Ictalurus melas (Rafinesque)
Ictalurus meridionalis Günther
Ictalurus natalis (Lesueur)
Ictalurus nebulosus (Lesueur)
Ictalurus nebulosus marmoratus (Holbrook)
Ictalurus punctuatus (Rafinesque)
Pylodictis olivaris (Rafinesque)

Family Bagridae

Auchenoglanis occidentalis Boulenger
Bagrus bayad Forskål
Bagrus docmac (Forskål)
Chrysichthys longibarbis Boulenger
Chrysichthys nigrodigitatus (Lacépède)
Chrysichthys walkeri Günther

Family Claridae

Clarias batrachus (Linnaeus)
Clarias lazera Cuvier and Valenciennes
Clarias macrocephalus Günther
Heterobranchus longifilis Cuvier and Valenciennes

Family Schilbeidae

Eutropius depressirostris Peters

Family Heteropneustidae

Heteropneustes fossilis (Bloch)

Family Pangasidae

Pangasius larnaudi Becourt
Pangasius micronemus Bleeker
Pangasius pangasius (Hamilton)
Pangasius sanitwongsei H.M. Smith
Pangasius sutchi Fowler

Family Pimelodidae

Pimelodus clarias Bloch
Rhamdia guatemalensis (Günther)

Family Esocidae

Esox lucius Linnaeus
Esox masquinongy Mitchill

Family Cyprinodontidae

Aplocheilus dayi (Steindachner)
Aplocheilus lineatus (Valenciennes)
Aplocheilus panchax (Hamilton)
Nothobranchius taenipygus Hilgandorf
Oryzias melastigmus (McClelland)

Family Poeciliidae

Gambusia affinis affinis (Baird and Girard)
Gambusia affinis holbrooki (Girard)

Family Gadidae

Gadus morhua Linnaeus

Family Paralichthyidae

Paralichthys lethostigma Jordon and Gilbert
Paralichthys olivaceus Temminck and Schlegel

Family Pleuronectidae

Limanda yokohamae (Günther)
Pleuronectes platesa Linnaeus

Family Soleidae

Solea solea (Linnaeus)

Family Ophichephalidae

Ophiocephalus marulius Hamilton
Syn. *Channa marulius* (Hamilton)
Ophiocephalus obscurus Günther
Ophiocephalus punctatus (Bloch)
Syn. *Channa punctatus* (Bloch)
Ophiocephalus striatus Bloch
Syn. *Channa striatus* (Bloch)

Family Helostomidae

Helostoma temmincki Cuvier

Family Osphronemidae

Osphronemus goramy (Lacépède)
Trichogaster pectoralis (Regan)
Trichogaster trichopterus (Pallas)

Family Anabantidae

Anabas testudineus (Bloch)

Family Atherinidae

Atherinichthys bonariensis (Cuvier and Valenciennes)
Chirostoma bartoni Jordan and Evermann
Chirostoma estor Jordan
Chirostoma grandocule Steindachner
Odonthestes (Basilichthys) bonariensis (Cuvier and Valenciennes)

Family Mugilidae

Mugil auratus Risso
Mugil brasiliensis Spix
Mugil capito Cuvier
Syn. *Mugil remada* Risso
Mugil cephalus Linnaeus
Mugil chelo Cuvier
Mugil cunnesius Valenciennes
Mugil curema Valenciennes
Mugil falcipinnis Valenciennes
Mugil grandisquamis Valenciennes
Mugil macrolepis (Smith) Aguas
Mugil parsia Hamilton
Syn. *Mugil dussumieri* Valenciennes
Mugil saliens Risso
Mugil tade Forskål
Rhinomugil corsula (Hamilton)

Family Polynemidae

Eleutheronema tetradactylum (Shaw)

Family Scombridae

Pneumatopharus japonicus diego (Ayres)

Family Carangidae

Caranx delicatissimus (Döderlein)
Seriola purpurascens Temminck and Schlegel
Seriola quiniqueradiata Temminck and Schlegel
Trachinotus carolinus (Linnaeus)

Family Percidae

Perca flavescens (Mitchill)
Perca fluviatilis Linnaeus
Stizostedion (Lucioperca) lucioperca (Linnaeus)
Stizostedion vitreum vitreum (Mitchill)

Family Centrarchidae

Lepomis cyanellus Rafinesque
Lepomis gibbosus (Linnaeus)
Lepomis humilis (Girard)
Lepomis macrochirus Rafinesque
Lepomis microlophus (Günther)
Micropterus coosae Hubbs and Bailey
Micropterus dolomieui Lacépède
Micropterus punctulatus (Rafinesque)
Micropterus salmoides (Lacépède)
Pomoxis annularis Rafinesque
Pomoxis nigromaculatus (Lesueur)

Family Centropomidae

Centropomis parallelus Poey
Centropomis unidecimalis Bloch
Lates calcarifer (Bloch)
Lates niloticus (Linnaeus)

Family Epinephelidae

Epinephelus sp.
Siniperca chuatsi (Basilewsky)

Family Percichthyidae

Morone mississippiensis Jordan and Eigenmann
Morone saxatilis (Walbaum)

Family Serranidae

Dicentrarchus labrax (Linnaeus)
Syns. Morone labrax (Linnaeus) and
Labrax lupus (Lacépède)
Dicentrarchus punctatus Bloch
Syn. Morone punctata (Bloch)
Lateolabrax japonicus (Cuvier and Valenciennes)

Family Sparidae

Chrysophrys major (Temminck and Schlegel)
Evynnis japonica Tanaka
Mylio macrocephalus (Bleeker)
Pagrus major (Temminck and Schlegel)
Sparus auratus Linnaeus
Syn. Chrysophrys aurata (Cuvier and
Valenciennes)

Family Sciaenidae

Aplodinotus grunniens Rafinesque
Cynoscion nebulosus (Mitchill)
Leiostomus xanthurus Lacépède
Plagioscion squamosissimus Heckel
Plagioscion surinamensis (Bleeker)
Pogonias cromis Linnaeus
Sciaenops oscellata (Linnaeus)

Family Oplegnathidae

Oplegnathus punctatus (Temminck and Schlegel)

Family Anoplopamatidae

Anoploma fimbria (Pallas)

Family Cichlidae

Astatoreochromis alluaudi Pellegrin
Syn. Haplochromis alluaudi (Boulenger)
Astronotus ocellatus (Agassiz in Spix)
Cichla ocellaris Bloch and Schneider
Cichla tamensis Gumboldt
Cichlasoma dovii (Günther)
Cichlasoma festivum Heckel
Cichlasoma guttulatum (Günther)
Cichlasoma macracanthus (Günther)
Cichlasoma managüense (Günther)
Cichlasoma motagüense (Günther)
Diapterus rhombeus Cuvier
Etroplus suratensis (Bloch)
Haplochromis carlottae (Boulenger)
Haplochromis mellandi (Boulenger)
Hemichromis bimaculatus Gill
Hemichromis fasciatus Peters
Paratilapia polleni (Bleeker)
Petenia esplendida Günther
Serranochromis angusticeps Boulenger
Syn. Paratilapia angusticeps Boulenger
Serranochromis macrocephala (Boulenger)
Syn. Paratilapia macrocephala Boulenger
Serranochromis robustus (Günther)
Syn. Pelmatochromis robustus Günther
Serranochromis thumbergi (Castelnau)
Syn. Paratilapia thumbergi Castelnau
Tilapia andersonii Castelnau
Tilapia aurea (Steindachner)
Tilapia christyi Boulenger
Tilapia esculenta Graham
Tilapia flavomarginata Boulenger
Tilapia galilaea (Artedi)
Tilapia heudelotii Dumeril
Syn. Tilapia macrocephala (Bleeker)
Tilapia hornorum Trewavas
Tilapia leucosticta Trewavas
Tilapia macrochir Boulenger
Tilapia marginata (Heckel)
Tilapia melanopleura Dumeril
Syn. Tilapia rendalli (Boulenger)
Tilapia mossambica Peters
Tilapia multifasciata (Günther)
Tilapia nigra (Günther)
Tilapia nilotica (Linnaeus)
Tilapia shirana Boulenger
Tilapia sparrmani A. Smith
Tilapia tholloni (Sauvage)
Tilapia variabilis Boulenger
Tilapia zilli (Gervais)
Syn. Tilapia zilli guineensis (Bleeker)
Tylochromis lateralis (Dumeril)
Syn. Chromis lateralis (Dumeril)

Family Eleotridae

Oxyeleotris mermorata (Bleeker)

Family Gobiidae

Dormitator latifrons Richardson

Family Tetraodontidae

Fugu rubripes (Temminck and Schlegel)
Tetradon fahaca Linnaeus

Family Monacanthidae

Navodon modestus (Günther)
Stephanolepis cirrhifer Temminck and Schlegel

Class Amphibia
Order Anura Batrachia
Sub-order Amphicoela
Family Ranidae

Rana aurora Baird and Girard
Rana boylei Baird
Rana catesbeiana Shaw
Rana clamitans Latreille
Rana grylio Stejneger
Rana hexadactyla Lesson
Rana palustris Le Conte
Rana pipiens Schreber
Rana tigrina Daudin

Class Reptilia
Order Chelonia (Testudinata)
Sub-order Cryptodira
Family Chelydridae

Chelydra serpentina Linnaeus

Family Emydiae

Malaclemys terrapin centrata (Latreille)
Malaclemys terrapin littoralis Hay
Malaclemys terrapin terrapin (Schoepff)

Family Trionychidae

Trionyx sinensis Wiegmann
Syn. *Amyda sinensis* Wiegmann

Class Mammalia
Order Rodentia
Sub-order Hystricomorpha
Family Capromyidae

Myocastor coypus (Molina)

Order Sirenia
Sub-order Trichechiformes
Family Trichechidae

Trichechus manatus manatus Linnaeus
Syn. *Manatus manatus* (Linnaeus)

2. AQUATIC PLANTS

2.1 Algae, diatoms

Ahnfeltia plicata (Hudson) Fries var. tobuchiensis Kanno & Matsub

Red alga. (Phyllophoraceae). Marine waters. Northeast coast of Asia. Experimental culture in Lake Tobuchi, Japan. Source of Sachalin agar.

Caulerpa racemosa (Forskål) Weber-van-Bosse

Green alga. (Caulerpaceae). Marine and brackish waters. Widely distributed. Cultivated in Philippines in large containers. Quite edible, pleasant taste.

Chaetomorpha antennica Kuetz

Green alga. (Cladophoraceae). Marine and brackish waters. Pacific Ocean and adjacent waters. Cultivated in Philippines for Chanos culture in brackishwater ponds. Consumed as food. Used for manufacture of a sweet meat.

Chaetomorpha crassa Kuetz

Green alga. (Cladophoraceae). Marine and brackish waters. Pacific Ocean and adjacent waters. Cultivated in Philippines. Use similar to C. antennica.

Chlorella ellipsoidea Gerneck

Green alga. (Oocystaceae). Fresh and brackish waters. Widely distributed. Pilot scale Chlorella farms have been established in America, Japan, Holland, Germany and Israel. Used as food by human beings and for fish cultivation.

Chlorella pyrenoidosa Chick

Green alga. (Oocystaceae). Fresh waters. Widely distributed. Other details same as C. ellipsoidea.

Chlorella vulgaris Beijerinck

Green alga. (Oocystaceae). Fresh waters. Widely distributed. Other details same as C. ellipsoidea.

Cladophora sp.

Green alga. (Cladophoraceae). Marine and brackish waters. Widely distributed. Limited cultivation in brackishwater fish ponds in Philippines by application of commercial fertilizers.

Coccochloris (Microcystis) aeruginosa (Nageli) Drouet & Daily

Blue green alga. (Chroococcaceae). Fresh waters. Japan. Encouraged to grow in eel ponds. Besides giving out oxygen for eels, the plant has a very high nitrate demand and so absorbs pollution products from the pond.

Cyclotella sp.

(Coscinodiscaceae). Mass culture in U.S.A. for feeding fish.

Enteromorpha compressa (Linneaus) Greville

Green alga. (Ulvaceae). Marine and brackish waters. Pacific and adjacent oceans. Cultivated in Philippines for Chanos culture in brackishwater ponds.

Eucheuma edula J. Agardh

Red alga. (Solieriaceae). Marine waters. Indian Ocean, Tropical Pacific. Experimental cultivation in Indonesia. Used for making agar agar.

Eucheuma muricatum (Gmelin) Weber-van-Bosse
(Syn. E. spinosum (Linnaeus) J. Agardh)

Red alga. (Solieriaceae). Marine waters. Indian Ocean, Tropical Pacific. Experimental cultivation in Indonesia. Used for making agar agar.

Gelidium amansii Lamour

Red alga. (Gelidiaceae). Coasts of China, Japan, South Africa. Limited cultivation in Japan and China. Used for making agar agar.

Gloiopeltis coliformis Harvey

Red alga. ('Funori'). (Endocladiaceae). Marine waters. Pacific North America, China, Japan. Limited cultivation in Osaka (Japan). Used for sizing fabrics.

Gloiopeltis furcata (Postels & Ruprecht) J. Agardh

Red alga. ('Funori'). (Endocladiaceae). Marine waters. Pacific North America, China, Japan. Limited cultivation in Osaka (Japan). Used for sizing fabrics.

Gracilaria verrucosa (Hudson) Papenfuss

Red alga. (Gracilariaceae). Marine waters. World-wide distribution. Cultivated in Tokyo Bay and some lagoons by putting small pieces of alga in twist of ropes, in waters rich in nutrients.

Gracilaria sp.

Red alga. ('Ogonori'). (Gracilariaceae). Marine and brackish waters. Japanese coast. Cultivated in Tokyo Bay by suspending branches of the plant in waters rich in nutrients. Not considered to be economic culture at present. Cultivated in China (Taiwan) also, where growth is reported to be best during spring and autumn. Salinity of 25 ppt found to be good for growth of the alga.

Gymnodinium brevis Davis

Red tide organism. (Gymnodiniaceae). Marine waters. Widely distributed. Cultivated artificially in Florida for researches on control of red tide.

Hemidinium sp.

(Glenodiniaceae). Marine and brackish waters. Widely distributed. Cultivated for bioassay work because of its high requirement of B_{12}. May become very useful as an assay organism for estuarine waters.

Laminaria japonica Areschong

Brown alga. (Japanese kelp, 'Kombu'). (Laminariaceae). Marine waters. Coast of east Asia, especially Japan, Korea and Siberia. Cultivated in Japan and north China. Special type of farming in Japan by placing clean rocks, concrete cylinders, etc. in the sea.

Laminaria ochotensis Miyabe

Brown alga. (Japanese kelp, 'Kombu'). (Laminariaceae). Marine waters. Japanese coast. Cultivated in Japan Sea and Aniwa Bay by placing large rocks in the sea.

Monostroma crassissimum Iwanoto

Green alga. (Awo-nori). (Monostromataceae). Marine waters. Japanese coast. Cultivated in Tokyo Bay for food purposes, on 'hibi' in specific areas of shallow waters. Certain areas of the culture grounds are called 'taneba', where fixed spores and germlings appear in appreciable quantities.

Monostroma grevillei (Thuret) Wittrock

Green alga. (Awo-nori).(Monostromataceae). Marine waters. Japanese coast. Details same as M. crassissimum.

Monostroma latissimum (Kutzing) Wittrock

Green alga. (Awo-nori). (Monostromataceae). Marine waters. Japanese coast. Details same as M. crassissimum.

Monostroma nitidum Wittrock

Green alga (Awo-nori). (Monostromataceae). Marine waters. Widely distributed. Cultivated in Japan as a source of food like Porphyra.

Monostroma tubiliforme Iwanoto

Green alga. ('Awo-nori'). (Monostromataceae). Marine waters. Japanese coast. Details same as M. crassissimum. Reported to favour regions with lowered salinity.

Nitzschia closterium (Ehrenberg) W. Smith

Diatom. (Nitzschiaceae). Marine, brackish and fresh waters. Widely distributed. Experimental cultivation in Japan for feeding oysters and pearl oysters.

Phaeodactylum tricornutum Bohlin

Diatom. (Phaeodactylaceae). Marine waters. Widely distributed. Experimental cultivation in England in concrete tanks using fertilized sea water, for oyster feeding.

Porphyra angusta Okamura & Ueda forma sanrikuensis Kurogi

Red alga. (Bangiaceae). Marine waters. Japanese coast. Cultivated in Japan, specially in the cultivation ground of Shukuncha, on 'hibi'. Japanese name : 'Nise-kosujinori'.

Porphyra kuniedai Kurogi

Red alga. (Bangiaceae). Marine waters. Japanese coast. Cultivated in Japan, specially in the cultivation ground of Shukunoha, on 'hibi'.

Porphyra okamurai Ueda

Red alga. (Bangiaceae). Marine waters. Japanese coast. Cultivated in Japan, in the cultivation ground of Shukunoha, on rocks and 'phyllospadix'.

Porphyra pseudolinearis Ueda

Red alga. (Bangiaceae). Marine waters. Japanese coast. Cultivated in Japan, specially in the cultivation ground of Shukunoha, on 'hibi' and on artificial reefs at Saghalien.

Porphyra tenera Kjellman

Red alga. ('Amanori'). (Bangiaceae). Marine waters. Coast of East Asia, especially around China and Japan. Cultivated in Japan and China, specially in Tokyo Bay. Used for the preparation of 'amanori' in Japan, and for cooking in China and Japan. 'Nori' or 'laver' is prepared from this alga.

Porphyra umbilicalis (Linnaeus) Kuetz

Red alga. (Bangiaceae). Marine waters. Coast of Japan, England and Wales. Experimental cultivation in Japan (east Hokkaido). Reported to be cultivated since 1960 in Matsushima Bay, Saghalien, etc.

Porphyra variegata (Kjellman) Hudson

Red alga. (Bangiaceae). Marine waters. Japanese coast. Cultivated in Japan, in the cultivation ground of Shukunoha, on rocks and 'phyllospadix'.

Porphyra vulgaris J. Agardh
(Syn. P. laciniata J. Agardh)

Red alga. (Bangiaceae). Marine waters. Pacific Ocean, Atlantic Ocean and adjacent waters. Cultivated along Japanese coast. Dried and used as food called 'Asakusanori'. Also eaten along coast of Great Britain.

Porphyra yezoensis Ueda

Red alga. (Bangiaceae). Marine waters. Japanese coast. Cultivated in Japan, specially in the cultivation ground of Shukunoha, on 'hibi' and on artificial reefs at Saghalien.

Scenedesmus obliquus (Turpin) Kuetz

Green alga. (Scenedesmaceae). Fresh waters. Widely distributed. Cultivated in Japan for feeding test animals like albino rat, gold fish, etc.

Skeletonema costatum (Greville) Cleve

Diatom. (Skeletonemaceae). Marine waters. Widely distributed. Experimental cultivation in Japan, China (Taiwan), etc. for feeding juvenile prawns.

Spirulina maxima (Seth & Gardner)

Blue green alga. (Oscillatoriaceae). Marine, brackish and fresh waters. Coast of Europe. Cultivated in open air ponds at Institute Français de Petrole, France.

Thalassiosira sp.

(Thalassiosiraceae). Mass culture in U.S.A. for feeding fish.

Undaria pinnatifida (Harvey) Suringar

Brown alga. (Lessoniaceae). Marine waters. East coast of Asia, especially China and Japan. Cultivated in Japan adopting long-line method with rope. Special cultivating field in Kagoshima City. Used as food in China and Japan with vinegar, after boiling or roasting.

Miscellaneous : 'Lab-lab' which is a biological complex of fungi, bacteria, diatoms, algae and small animals, is extensively cultivated in milkfish ('Bangos') nursery ponds in Philippines.

2.2 Angiosperms

Eleocharis planktaginea Robert Brown

Water chestnut. (Cyperaceae). Fresh waters. Java, Celebes. Perennial herb, used for basket work in Indonesia.

Eleocharis tuberosa Schutters

Water chestnut. (Cyperaceae). Fresh waters. Eastern India, China, Japan. Perennial herb, cultivated in China and Japan. Tuber consumed in Chinese dishes.

Hydrolea zeylanica (Linnaeus) Vahl

(Hydrophyllaceae). Fresh waters. Tropical Asia. Herbaceous plant. Young leaves are eaten as lalab with rice in Java. Leaves considered to be antiseptic.

Ipomoea aquaticia Forskål

Water spinach; Chinese cabbage. (Convolvulaceae). Fresh waters. Tropical Asia. Cultivated in some parts of Asia like China, Hong Kong, China (Taiwan), Indonesia, and Malaysia. Experimental cultivation in Fiji, Florida and Hawaii. Perennial creeping herb. Leaves and shoots are cooked and eaten.

Lemna sp.

Duckweed. (Lemnaceae). Fresh waters. Widely distributed. Generally encountered as weed in waters used for fish culture. However, cultivated in some Far East countries, in well-manured pits, by fish fry dealers, as food for young grass carp.

Nelumbium speciosum Willdenow

Lotus. (Nymphaeaceae). Fresh waters. Tropical Asia. Perennial. Boiled rhizomes, young leaves and dry seeds consumed in China, Japan, etc. Source of a starch, lotus meal. Also preserved in sugar. In Indo-China, stamens used for flavouring tea. In India cultivated for the flowers.

Nymphaea lotus Linnaeus

White lotus. (Nymphaeaceae). Fresh waters. Tropical Africa and Asia. Perennial. Root powder used for dyspepsia, dysentery and piles. Powdered seeds used as cure for skin diseases in Sudan. Ornamental flowers.

Nymphaea stellata Willdenow

Indian blue lotus. (Nymphaeaceae). Fresh waters. Southeast Asia, tropical Africa. Rhizomes, petiole and seeds are edible.

Oryza sativa Linnaeus (Aquatic varieties).

Rice. (Graminaceae). Fresh waters. Asia. Aquatic varieties cultivated in deep waters (5-9 m) in Assam and in west Bengal (India).

Trapa bicornis Linnaeus

Water chestnut. (Onagrariaceae). Fresh waters. Far East countries. Annual. Cultivated in China, Korea and Japan. Seeds used as food.

Trapa bispinosa Roxburgh

Water chestnut; Singhara Nut. (Onagrariaceae). Fresh waters. Tropical Asia. Cultivated in India, especially in Kashmir. Raw seeds and flour are edible. Dried seeds are source of starch.

Trapa natans Linnaeus

Water chestnut; water caltrop; Jesuits-nut. (Onagrariaceae). Fresh waters. Europe, Mediterranean, Asia. Introduced in North America and Australia. Cultivated mainly in Kashmir (India) for the seeds, which are used as food, and also made into rosaries.

Wolffia sp.

Duckweed. (Lemnaceae). Fresh waters. Widely distributed. Generally encountered as weed in waters used for fish culture. However, cultivated in some Far East countries, in well-manured pits, by fish fry dealers, as food for young grass carp.

3. PORIFERA

Euspongia officinalis adriatica (O. Schmidt)

Turkey toilet sponge. (Spongiidae). Marine waters. Mediterranean. Limited cultivation in Tunisia.

Euspongia officinalis lamella (Schulze)

Elephant ear sponge. (Spongiidae). Marine waters. Mediterranean. Limited cultivation in Tunisia.

Euspongia officinalis mollissima (O. Schmidt)

Turkey cup; solid sponge. (Spongiidae). Marine waters. Mediterranean. Limited cultivation in Tunisia.

Hippiospongia canaliculata flabellum Lendenfeld

Glove sponge. (Spongiidae). Marine waters. Atlantic. Limited cultivation in Bahamas, Honduras, West Indies.

Hippiospongia grossypina (Duchassaing & Michelotti)

Velvet sponge. (Spongiidae). Marine waters. Atlantic. Limited cultivation in Bahamas; Honduras.

Hippiospongia lachne de Laubenfels

Wool sponge. (Spongiidae). Marine waters. Atlantic. Limited cultivation in Bahamas, Honduras. This is the basic sponge of commerce. Average height, 18 cm; average diameter, 23 cm.

Spongia agaricina corlosia (Duchassaing & Michelotti)

Hard-head sponge. (Spongiidae). Marine waters. Atlantic. Limited cultivation in Bahamas.

Spongia barbara Duchassaing & Michelotti

Yellow sponge. (Spongiidae). Marine waters. Atlantic. Limited cultivation in Florida, West Indies.

Spongia dura Hyatt

Hard-head sponge. (Spongiidae). Marine waters. Atlantic. Limited cultivation in Bahamas.

Spongia graminea Hyatt

Grass sponge. (Spongiidae). Marine waters. Atlantic. Limited cultivation in Bahamas, Honduras.

Spongia obliqua Duchassaing & Michelotti

Reef sponge. (Spongiidae). Marine waters. Atlantic. Limited cultivation in Bahamas, Honduras.

Spongilla spp.

Freshwater sponge. (Spongillidae). Fresh waters. Widely distributed. Experimental cultivation in different countries.

4. ROTIFERA

Brachionus calyciflorus Pallas

Wheel animalcule. (Brachionidae). Fresh waters. Widely distributed. Joint culture with Moina sp., as fish food, in U.S.S.R. Best food algae or algae with bacteria. Optimum temperature for reproduction: 21-22°C. Supplementary feeding with yeast.

Brachionus plicatilis Müller

Wheel animalcule. (Brachionidae). Fresh and saline waters. Widely distributed. Cultivated in Japan on mass scale, as food for fish and prawns.

Brachionus rubens Ehrenberg

Wheel animalcule. (Brachionidae). Fresh waters. Widely distributed. Joint culture with Moina sp., as fish food in U.S.S.R.

5. ANNELIDA

Arenicola cristata (Stimpson)

Lugworm. (Arenicolidae). Marine waters. Atlantic, Gulf and Pacific Coast of U.S.A. Cultivated on experimental scale in Florida. Good bait for a number of fishes. After hatching the worm feeds on mixed organic detritus in sediments. Rapid growth, tolerance to low D.O. and crowding, and sedentary habit are significant characters.

Lugworms (species not reported) cultivated in U.S.S.R. also for feeding sturgeon and in the U.S.A. for feeding aquarium fish.

Enchytraeus albidus (?)

(Enchytraeidae). An oligochaete, artificially cultivated in wooden trays, in air conditioned rooms, in U.S.S.R. Breed throughout the year. Stored at -1 to +1°C to feed sturgeon larvae.

6. CRUSTACEA

6.1 Anostraca

Artemia salina (Linnaeus)

Brine shrimp. (Artemiidae). Marine and brackish waters. Widely distributed. Mass scale culture in many countries as food for larvae of fish, prawns, etc. Also cultivated in very saline ponds, where other species cannot thrive.

6.2 Cladocera

Chydorus sphaericus (Müller)

Water-flea. (Chydoridae). Widely distributed. Cultivated in cement cisterns in U.S.S.R. using horse manure, yeast, etc., either singly or along with Daphnia magna.

Daphnia carinata King

Water-flea. (Daphnidae). Widely distributed. Mass culture in Japan as fish food. Standard medium: Scenedesmus obliquus in 1 litre of fresh water previously added with 0.5 ppm P K_2 HPO_4 and 3.5 ppm N(NH_2) CO as nutrients. Better growth reported at 18°C.

Daphnia magna Straus

Water-flea. (Daphnidae). Widely distributed. Cultivated in cement cisterns in U.S.S.R. to feed sturgeon. Mass culture as fish food in South Africa also. Lowering temperature delays maturing of the organism and prolongs period of the changing of generations.

Daphnia pulex Leydig

Water-flea. (Daphnidae). Widely distributed. Cultivated in U.S.S.R. as food for sturgeon. Other details same as D. magna.

Daphnia spp.

Water-flea. (Daphnidae). Mass culture in different countries as food for cultivated fishes.

Moina macrocopa Straus

Water-flea. (Daphnidae). Widely distributed. Mass culture in U.S.S.R. and Japan as live food for larvae of white fish. Joint culture with rotifers.

Moina spp.

Water-flea. (Daphnidae). Widely distributed. Mass culture in different countries as fish food.

Polyphemus pediculus (Linnaeus)

Water-flea. (Polyphemidae). Inland waters of North America. Limited culture in Wisconsin as initial feed for muskellenge fry. Reproduces rapidly in still waters.

Simocephalus sp.

Water-flea. (Daphnidae). Widely distributed. Mass culture in U.S.S.R. for feeding sturgeon.

6.3 Amphipoda

Gammarus sp.

(Gammaridae). Cultivated in a limited sense and given as food for carps cultured in running waters, in Japan. Probably, the organism supplies necessary vitamins to fish.

6.4 Decapoda

Astacus sp.

Freshwater crayfish. (Astacidae). Fresh waters. Widely distributed. Experimental cultivation in U.S.S.R. up to 90 young have been hatched from each female stripped. Six to ten days old hatchlings are released into ponds, rivers and lakes.

Caridina gracilirostris De Man

Shrimp. (Atydidae). Cultivated in coastal paddy fields of Kerala (India), Malaysia, Singapore, Cocos and Keeling Islands.

Crangon crangon (Linnaeus)

Shrimp. (Crangonidae). Marine and brackish waters. Experimental cultivation in some European countries.

Homarus americanus H. Milne Edwards

American lobster. (Nephropsidae). Marine waters. American coast. Experimental hatcheries established in many parts of U.S.A. Experimental culture in coves in British Columbia, where adults are maintained for spawning; fed with fish and crushed mussels.

Homarus vulgaris H. Milne Edwards

Lobster. (Nephropsidae). Marine waters. European coast. Experimental culture in U.K. and some other European countries.

Homarus sp.

Lobster. (Nephropsidae). Marine waters. Artificial rearing in New Zealand.

Jasus edwardsii (Hutton)

Spiny lobster; marine cray fish. (Palinuridae). Australian coast. Experimental cultivation in New Zealand. Reared up to 12 months in concrete-asbestos tanks. Favours fresh live mussels as food. Extremely sensitive to pollution.

Macrobrachium acanthurus (Wiegmann)

Freshwater shrimp. (Palaemonidae). Marine, brackish and fresh waters. North America. Experimental cultivation in Florida, Mexico and Peru. Hardy, omnivorous scavengers. Cannibalistic. Able to spend time out of water. Sensitive to cold.

Macrobrachium americanum Bate

Freshwater prawn. (Palaemonidae). Pacific states of Mexico. Experimental culture in western Mexico. Males grow to about 450 g and females to 225 g.

Macrobrachium carcinus (Linnaeus)

Freshwater shrimp. (Palaemonidae). Marine, brackish and fresh waters. Experimental cultivation in Florida. Able to tolerate tap water with low chloride content.

Macrobrachium idae (Heller)

Shrimp. (Palaemonidae). Fresh waters. Indo-West Pacific. Cultivated in a limited sense; the species appears in catches from coastal paddy fields of Kerala (India), but not in commercial quantities.

Macrobrachium lanchesteri (De Man)

Freshwater shrimp. (Palaemonidae). Fresh waters. Thailand, Malay Peninsula. Found in swamps and rice fields. Cultivated in Singapore and Malaysia. Can tolerate salinity up to 20 ppm. Temperature preference: 26 to 36°C. Algal feeder. Breeds under pond conditions. Able to tolerate low oxygen contents.

Macrobrachium malcolmsonii (H. Milne Edwards)

Shrimp. (Palaemonidae). Brackish and fresh waters. India, Burma and Pakistan. Experimental culture in India and Pakistan.

Macrobrachium rosenbergii (De Man)

Giant freshwater prawn. (Palaemonidae). Brackish and fresh waters. Indo-Pacific. Successfully reared and cultivated in Malaysia, Thailand and Hawaii. Reaches nearly 30 cm in length. In Thailand young are collected from streams and stocked in ponds. In Indonesia fry raised to a length of 16 to 20 cm. The species is essentially a freshwater prawn, but breeds in brackish waters. Larvae require saline water for survival and growth. Reared in brackishwater impoundments in India and Pakistan. Very limited cultivation in Singapore ponds.

Macrobrachium rude (Heller)

Freshwater prawn. (Palaemonidae). Brackish and fresh waters. East Africa, Madagascar and India. Cultivated in coastal paddy fields of Kerala and 'bheris' of West Bengal (India).

Macrobrachium sintangense (De Man)

Freshwater shrimp. (Palaemonidae). Fresh waters. South East Asia. Limited cultivation in ponds of Singapore and Malaysia.

Metapenaeus affinis (H. Milne Edwards)

Shrimp. (Penaeidae). Marine and brackish waters. Indo-Pacific. Cultivated in coastal paddy fields of Kerala (India). Able to tolerate salinity changes. Omnivorous feeder.

Metapenaeus barbata De Haan

Shrimp. (Penaeidae). Marine and brackish waters. Malay Peninsula. Very limited cultivation in Singapore ponds.

Metapenaeus bennettae Racek & Dall

Australian greasy-back prawn. (Penaeidae). Estuaries of eastern Australia. Artificial farming in Australia. Able to tolerate wide fluctuations in temperature and salinity. Adapted to spawning in estuaries if landlocked. Grows to 13 cm and 46 g.

Metapenaeus brevicornis (H. Milne Edwards)

Yellow prawn. (Penaeidae). Marine and brackish waters. Indo-West Pacific. Cultivated in Indonesia, Singapore, Malaysia, Thailand, etc; also in 'bheris' of India and Pakistan. Able to tolerate nearly freshwater conditions. Omnivorous feeder.

Metapenaeus burkenroadi Kubo

Marine shrimp. (Penaeidae). Marine and brackish waters. Widely distributed. Cultivated in Singapore ponds.

Metapenaeus dobsoni (Miers)

Shrimp. (Penaeidae). Marine and brackish waters. Indo-Pacific. Cultivated in coastal paddy fields of Kerala (India). Grows to 61-65 mm in about 4-5 months. Tolerates wide salinity variations. Feeds on foraminiferans, nematodes, copepods, amphipods, cladocerans and diatoms.

Metapenaeus elegans De Man

Shrimp. (Penaeidae). Marine and brackish waters. Sporadic occurrence in Singapore prawn ponds.

Metapenaeus ensis (De Haan)

Shrimp. (Penaeidae). Marine and brackish waters. Indo-West Pacific. Cultivated in brackishwater ponds in Philippines, China (Taiwan) Singapore and Malaysia. Feeds mainly on worms and insect larvae.

Metapenaeus intermedius (Kishinouye)

Shrimp. (Penaeidae). Marine and brackish waters. Sporadic occurrence in Singapore prawn ponds.

Metapenaeus joyneri (Miers)

Shrimp. (Penaeidae). Marine and brackish waters. China to Japan. Moderate cultivation in China (Taiwan) with milkfish. Grows to 11 cm length and 45-50 g weight.

Metapenaeus lysianassa (De Man)

Shrimp. (Penaeidae). Marine and brackish waters. Sporadic occurrence in Singapore prawn ponds.

Metapenaeus monoceros (Fabricius)

Shrimp. (Penaeidae). Marine and brackish waters. Indo-Pacific. Cultivated in China (Taiwan) Philippines, Indonesia, Thailand, India and Pakistan. Able to tolerate wide fluctations in salinity. Thrives and grows well in marine and brackish waters; sometimes in fresh water also.

Metapenaeus mutatus (Lanchester)

Shrimp. (Penaeidae). Marine and brackish waters. Sporadic occurrence in Singapore prawn ponds.

Metapenaeus spinulatus Kubo

Shrimp. (Penaeidae). Marine and brackish waters. Sporadic occurrence in Singapore prawn ponds.

Neptunus pelagicus (Linnaeus)

Blue swimming crab. (Portunidae). Marine and brackish waters. Mostly Indo-Pacific. Cultivated in Japan on pilot scale.

Orconectes propinquus (Girard)

Crayfish. (Astacidae). Fresh waters. North America. Limited cultivation in U.S.A. ponds as food for fishes.

Pacifastacus leniusculus (Dana)

Crayfish. (Astacidae). Fresh waters. North America. Cultivated in rice fields and impoundments in Oregon (U.S.A.). Edible size of 15 to 20 g reached in 210 days. Feeds on vegetable matter and insect larvae. Cannibalistic. Recently introduced in Finland for stocking purpose.

Palaemon paucidens De Haan

Prawn. (Palaemonidae). Marine, brackish and fresh waters. Southern Siberia, China and Japan. Cultivated in farm ponds in Japan along with carps. One generation lasts one year. Hatching takes place during April to July. Matures at 32 mm.

Palaemon styliferus H. Milne Edwards

Prawn. (Palaemonidae). Marine, brackish and fresh waters. India to Thailand, Bornea and Java. Cultivated in coastal paddy fields of Kerala and 'bheris' of West Bengal (India). Omnivorous feeder. Breeds in estuaries and sea.

Palaemonetes kadiakensis Rathbun

Shrimp. (Palaemonidae). Fresh waters. North America. Experimental cultivation in U.S.A. ponds along with bluegill.

Palaemonetes sp.

Hard-back shrimp. (Palaemonidae). Grown as forage organism for game fish in brackish-water ponds of southern California (U.S.A.)

Panopeus herstii H. Milne Edwards

Mud crab. (Xanthidae). Grown as forage organism for game fish in brackishwater impoundments in southern California (U.S.A.).

Panulirus argus (Latreille)

Spiny lobster. (Palinuridae). Marine and brackish waters. Atlantic. Experimental rearing in Florida. Larval life: 6-7 months. Does not survive in salinities below 19 ppm. Tropical and semi-tropical temperature regimes required for rearing.

Panulirus japonicus (De Haan)

Lobster. (Palinuridae). Marine waters. Japan coast. Successful artificial propagation reported in Japan.

Parapenaeopsis tenella (Bate)

Prawn. (Penaeidae). Marine and brackish waters. Occurs in Singapore prawn ponds, though not in appreciable number.

Penaeus aztecus Ives

Brown shrimp. (Penaeidae). Marine and brackish waters. Gulf of Mexico; east coast of U.S.A. Experimental mass culture in U.S.A. Reared in laboratories up to post larval stages and then transferred to ponds. Reported to attain 10.3 cm and 9 g in 145 days, in fertilized ponds. Estimated yield: 300 kg/ha. Salinity and temperature tolerance: 16-35 ppt and 8-37°C respectively.

Penaeus canaliculatus Olivier

Prawn. (Penaeidae). Marine and brackish waters. Indo-Pacific. Cultivated in estuarine ponds in Philippines. Feeds on benthic foraminiferans and other organisms. Tolerates wide variations in salinity.

Penaeus duorarum Burkenroad

Pink shrimp. (Penaeidae). Marine and brackish waters. Gulf of Mexico, Bermuda, Carribean and Brazil. Experimental cultivation in U.S.A., Africa, etc. Feeds on variety of small plants and animals as well as detritus. Tolerates wide variations in salinity.

Penaeus indicus H. Milne Edwards

Indian prawn. (Penaeidae). Marine and brackish waters. Indo-Pacific. Cultivated in Philippines, Thailand, Singapore, Malaysia and India. Most important coastal pond shrimp of Indonesia. Capable of withstanding wide range of salinity, this quality being pronounced in younger stages. Omnivorous feeder, the food being mainly detritus and smaller animals like crustaceans, polychaetes, etc. Breeds in deep seas and post larvae migrate into estuaries for feeding and growth.

Penaeus indicus longirostris (De Man)

Prawn. (Penaeidae). Marine and brackish waters. This variety is reported to be the most important prawn in coastal ponds in Indonesia.

Penaeus japonicus Bate

Japanese prawn. (Penaeidae). Marine and brackish waters. Indo-Pacific. Most important commercial prawn of Japan; cultivated in ponds, feeding with silk worm pupae and flesh of sardines. Cannibalistic. Hides under sand from dawn to dusk, and swims at night. Bred in ponds. Feeds on diatoms during zoea stage. Larval stage lasts 7 days. Juveniles in ponds fed on crushed clams, worms, squids, etc. Experimental cultivation in France and Korea.

Penaeus latisulcatus Kishinouye

Shrimp. (Penaeidae). Marine and brackish waters. Red Sea to Japan and Australia. Experimental cultivation in Thailand. Grows to 18 cm length and 12-15 g weight. Optimal habitat, mud and sand.

Penaeus merguiensis De Man

Banana prawn. (Penaeidae). Marine and brackish waters. Indo-Pacific. Cultivated in brackishwater ponds in Thailand, Singapore, Malaysia and Indonesia. Feeds on phytoplankton.

Penaeus monodon Fabricius

Tiger shrimp; Jumbo shrimp. (Penaeidae). Marine and brackish waters. Indo-Pacific. Cultivated in Philippines. Limited cultivation in China (Taiwan), Thailand, India etc. Fresh water more favourable during early stages, while brackish and saline waters conducive to

faster growth of later stages. Fry feed on plankton; adult on 'lab-lab', detritus, rice bran, crushed fish, etc. Marketable size in five months to one year. Attains average 23 cm and 95 to 120 g in one year. Production: 250 kg/ha in monoculture and 100 kg/ha in mixed culture.

Penaeus orientalis Kishinouye

Shrimp. (Penaeidae). Marine and brackish waters. China and Japan. Experimental cultivation in Korea following methods adopted in Japan for P. japonicus culture. Larval stage lasts 24 days and feeds on diatoms.

Penaeus semisulcatus (De Man)

Green tiger prawn. (Penaeidae). Marine and brackish waters. Indo-Pacific. Cultivated in ponds in Philippines, Indonesia, Singapore, Malaysia, etc. Able to tolerate wide salinity fluctuations. Omnivorous feeder.

Penaeus setiferus (Linnaeus)

White shrimp. (Penaeidae). Marine and brackish waters. East coast of U.S.A., north and northeast Mexican Gulf and Tortugas. Most commercially important species along south Atlantic and Gulf coasts of U.S.A. Cultivated in brackishwater ponds in U.S.A. Spawns in salinity 32 to 37 ppt. Production: in naturally stocked ponds about 182 kg/ha and in fertilized ponds up to about 1 300 kg/ha, in 5 months.

Penaeus teraoi Kubo

Shrimp. (Penaeidae). Marine and brackish waters. Experimental cultivation in Japan and China (Taiwan).

Procambarus blandingii (Harlan)

White river crayfish. (Astacidae). Fresh waters. North America. Cultivated in rice fields and impoundments in U.S.A. Inhabits open waters in winter and spring. Feeds on vegetable matter and insect larvae. Feeding activity optimum between 18 and 21°C. Cannibalistic. Production from ponds: 400 to 1 000 kg/ha.

Procambarus clarkii (Girard)

Red swamp crayfish. (Astacidae). Fresh waters. North America. Cultivated in U.S.A. adopting two methods: (i) A rice-crayfish pasture rotation in which crayfish is a secondary crop; (ii) Culture in swamp land used for waterfowl hunting. The species is omnivorous feeder with cannibalistic behaviour. Growth to minimum edible size of 15 to 20 g attained in about 210 days. Well managed field will yield 448 to 1 120 kg/ha. Can breed in waters ranging in salinity from 6 to 8 ppt.

Scylla serrata (Forskål)

Blue crab. (Scyllidae). Marine, brackish and fresh waters. Indo-Pacific. Cultivated in ponds in China (Taiwan), Philippines, Thailand, Singapore, etc. and 'bheris' and paddy fields in India and Pakistan. Successfully reared in laboratory from egg to adult. Usually grows to 15-20 cm across carapace. Causes damage to bunds by burrowing.

Trachypenaeus (Trachysalambrica) similis (Smith)

Shrimp. (Penaeidae). Marine and brackish waters. Atlantic. Experimentally reared on mass scale in U.S.A. Fed on phytoplankton from zoea stage onward; brine shrimp given as supplementary food.

Trachypenaeus spp.

Shrimp. (Penaeidae). Marine and brackish waters. Experimentally reared on mass scale in U.S.A. Occurs rarely in Singapore prawn ponds.

Varuna litterata (Fabricius)

Crab. (Grapsidae). Marine and brackish waters. Indo-Pacific. Cultivated in brackish-water impoundments in West Bengal (India) and East Pakistan.

Xiphopenaeus kryeri (Heller)

Sea bob. (Penaeidae). Marine and brackish waters. Occurs rarely in Singapore prawn ponds.

7. INSECTA

7.1 Diptera

Chironomus pulcher Wiedeman

(Chironomidae). Fresh waters. Widely distributed. Larvae cultivated on mass scale for use in feeding Tilapia, in Uganda.

Chironomus spp.

(Chironomidae). Fresh waters. Larvae cultivated in several countries as feed for fishes. In some European countries and U.S.S.R. bundles of reeds are immersed in water and pieces of meat put to decompose. Chironomids lay eggs in this and when larvae emerge they are collected.

8. MOLLUSCA

Anadara broughtonii (Schrenk)

Cockle. (Arcidae). Marine and brackish waters. Japan coast. Reared in tanks in Japan, mainly for experimental purposes.

Anadara granosa (Linnaeus)

Cockle. (Arcidae). Marine and brackish waters. Tropical Pacific. Cultivated in muddy estuarine areas of Thailand, Malaysia, Korea, etc. Also in West Java in shallow sea waters with muddy bottom. Attains marketable size of 5-7.5 cm in 6-7 months. Feeds on organic detritus and phytoplankton. Cockle 'gardens' are erected on rich cockle spat grounds.

Anadara granosa bisinensis Schrenk & Reinhart

Cockle. (Arcidae). Marine and brackish waters. Cultivated in Korea.

Anadara inflata Reeve

Cockle. (Arcidae). Marine and brackish waters. Cultivated in coastal waters of Banten (West Java) along with A. granosa.

Anadara subcrenata (Lischke)

Cockle. (Arcidae). Marine and brackish waters. Cultivated in Japan. Prefers shallow and calm sections of warm bays with mud or sandy mud bottom. Spawning season from July to early September, beginning at water temperature of about 25°C and with peak at about 27°C. Larvae become bottom dwellers 3-6 months after birth.

Anadara spp.

Cockle. (Arcidae). Marine and brackish waters. Cultivated in muddy estuarine areas of Thailand.

Arca granosa Lamarck

Ribbed ark-shell. (Arcidae). Marine and brackish waters. India, Pacific islands, etc. Cultivated in Japan. Flesh used as food. Attains marketable size in three years.

Arca sp.

Ark-shell clam. (Arcidae). Marine and brackish waters. Cultivated commercially in the Gulf, Thailand. Young are collected for this purpose from mud. Harvestable size attained in about 6 months.

Crassostrea angulata (Lamarck)

Portuguese oyster. (Ostreidae). Marine and brackish waters. Coast of Europe; introduced to other areas for culture. Commercial cultivation in coastal areas of France, brackishwater lakes of Tunisia, etc. Experimental culture in South Africa. Salinity tolerance: 21-43 ppt. Reported not to breed in lakes where salinity is about 34 ppt.

Crassostrea commercialis Iredale & Roughley

Sydney rock oyster. (Ostreidae). Marine and brackish waters. Australia and Hawaii. Cultivated in Australia, largely in estuaries and inlets of sea. Spat collected on wooden sticks and grown on racks or trays raised above surface of estuarine mud flats. Can survive out of water for two to three weeks depending on the temperature. Attains marketable size in a few months. Experimental culture tried in South Africa.

Crassostrea cucullata Born

Japanese oyster; Indian rock oyster. (Ostreidae). Marine and brackish waters. Japan, Australia, New Zealand and India. Cultivated in Japan on bamboo. Spat imported from Japan and cultivated in American waters. Commercially important cultivation in Philippines also. Limited cultivation in south India. Requires 8-12 months' growth to reach marketable size of 6-8 cm length. Harvested before spawning season (March-May). Feeds mainly on diatoms and protozoans.

Crassostrea gasar Adanson

Oyster. (Ostreidae). Marine and brackish waters. West coast of Africa from Senegal to Angola. Experimental cultivation in Nigeria. 7.5 cm growth observed in 9 months.

Crassostrea gigas (Thunberg)

Japanese oyster; Pacific oyster. (Ostreidae). Marine and brackish waters. Japan; transplanted to America (Alaska to California), New Zealand, Tasmania, France, etc. One of the largest cultivated oysters in Japan, Korea, Thailand, North America, Tasmania, New Zealand, etc. Experimental cultivation in Philippines, France, etc. Grows to 30 cm or

more. Hardy and can stand wide variations in temperature and salinity. Salinity tolerance: 8-36 ppt. Optimum salinity and temperature: 20-25 ppt and about 24°C. Grows best near estuaries. Attains marketable size of 10-15 cm in less than two years, but growth rate is extremely variable. Filter feeder, on bacteria, protozoa, diatoms, larval forms, detritus, etc.

Crassostrea glomerata Gould

Rock oyster. (Ostreidae). Marine waters. New Zealand. Farmed in New Zealand by placing the young taken from natural rocks and rock spawls in suitable locations on the foreshore.

Crassostrea gryphoides (Schlotheim)

Oyster. (Ostreidae). Marine waters. Indian seas. Limited farming in Kelwa, near Bombay (India).

Crassostrea margaritacea (Lamarck)

South American oyster. (Ostreidae). Marine and brackish waters. Coast of Africa. Experimental cultivation in Knysa lagoon, South Africa.

Crassostrea rhizophorae Guilding

Mangrove oyster. (Ostreidae). Marine and brackish waters. Cuba, Jamaica and Puerto Rico. Commercially exploited species; cultivation on scientific lines initiated in Venezuela, Cuba.

Crassostrea rivularis (Gould)

Edible oyster. (Ostreidae). Marine and brackish waters. Japan, India, etc. Cultivated in Japan for food purposes. Salinity tolerance: 7-34 ppt.

Crassostrea virginica (Gmelin)

Atlantic oyster; Eastern oyster. (Ostreidae). Marine and brackish waters. Gulf and Atlantic coast of U.S.A., West Indies and introduced in British Columbia. Cultivated in U.S.A. At present four hatcheries are reported to be working on commercial scale. Reaches marketable size in 2-4 years. Feeds on plankton. Spawning takes place when temperature increases within average range of 20-32°C. Salinity tolerance: 5-32 ppt with optimum between 10-28 ppt. Larvae grow best in 15-18 ppt salinity and temperature of 18-30°C.

Crassostrea vitrefacta Sow

Oyster. (Ostreidae). Marine and brackish waters. Cultivated in brackish waters of Thailand.

Cristaria plicata spatiosa (Clessin)

Pearl oyster. (Unionidae). Marine waters. Japan. Cultivated in Japan for pearls. Treated oysters are put in cages and suspended in sea. Pearl formation in six months; big ones in three years.

Haliotis discus hannai Ino

Pearl 'oyster'; abalone. (Haliotidae). Marine waters. Japan. Cultivated for pearls in Japan. Treated oysters are put in cages and suspended in sea. Pearl formation in six months; big ones in three years.

Hyriopsis schlegelli (Martens)

Pearl 'oyster'. (Unionidae). Marine waters. Japan. Cultivated in Japan for pearls. Details same as H. discus hannai.

Lampsilis claiborneensis Lea

Mussel. (Unionidae). Fresh water. East America. Cultivated along with fishes in U.S.A. The mussel clears the water by filtering, thereby increasing fish production. Cultivation reported to be still in experimental stage.

Mactra sulcataria Deshayes

Surf clam. (Mactridae). Marine waters. Japan. Propagated on the southwest coast of Tokyo Bay.

Mercenaria mercenaria (Linnaeus)

Hard clam. (Mercenaridae). Marine and brackish waters. Gulf of St. Laurence to Gulf of Mexico in North America. Experimental farming in U.S.A. Grown in protective boxes along Gulf and Atlantic coasts. Most specimens spawn when one year old. Feeds on plankton, mostly phyto. Larvae grow best in salinity of 25-27 ppt and temperature 18-30°C.

Hybrid of female Mercenaria campechiensis (Gmelin) x
male Mercenaria mercenaria (Linnaeus)

Experimental cultivation in boxes along Gulf and Atlantic coasts of U.S.A. for seed purposes.

Meretrix casta (Chemnitz)

Backwater clam. (Veneridae). East coast of India. Experimental cultivation reported from a marine fish farm in south India.

Meretrix lamarckii Deshayes

Clam. (Veneridae). Japan coast. Spawning season from July to September when water temperature rises above 25°C. Grows to 6.6 mm in shell length in one full year and 36 mm in two full years. In three full years the growth is about 51 mm. Largest specimens about 98 mm long. Requires sandy bottom, but is considered suitable for marine propagation.

Meretrix lusoria (Gmelin)

Clam. (Veneridae). Cultivated in Japan and Korea.

Meretrix meretrix (Linnaeus)

Hard clam; big clam. (Veneridae). Japan coast. Cultivated in Korea and Japan. Reaches marketable size of 5-7 cm in one to two years.

Murex trunculus (Linnaeus)

'Clam'. (Muricidae). Marine and brackish waters. Mediterranean. Collected from Tunisian coast and fattened in the Bizerta Lake (brackish water).

Mya arenaria Linnaeus

Soft clam; soft-shell clam. (Myidae). Marine waters. East and west coasts of North America, Norway-France, Japan, etc. Farmed in U.S.A. Feeds on phyto and zooplankton. In nature occurs in exposed areas of coast line.

Mytilus crassitesta Lisk

Sea mussel. (Mytilidae). Marine waters. Far East. Cultivated in Korea.

Mytilus edulis Linnaeus

Common mussel. (Mytilidae). Marine and brackish waters. Widely distributed. Cultivated in France, Spain, Germany, Italy, Netherlands, Denmark, England, Scotland, Canada, etc. Feeds on plankton (diatoms, protozoans) and detritus. Harvested when 7-8 cm in length. In Netherlands requires three years to grow to marketable size.

Mytilus galloprovincialis Lamarck

Mediterranean mussel. (Mytilidae). Marine and brackish waters. Mediterranean coasts. Cultivated in Taranto Gulf, Italy; brackishwater lakes of Tunisia; Greece, etc.

Mytilus smaragdinus Chemnitz
Syn. Mytilus viridis Linnaeus

Green Bay mussel. (Mytilidae). Marine and brackish waters. Far East. Cultivated in muddy estuarine areas, mostly on bamboo stake-traps, in Thailand. Cultivated also in oyster farms in Philippines or separately, following diverse methods. Harvested in six months at the average length of 5-8 cm. Feeds on 'lab-lab'. Spawns throughout the year. Optimum temperature 26-30°C and salinity 27-35 ppt.

Mytilus sp.

Mussel. (Mytilidae). Marine and brackish waters. Cultivated in muddy estuarine waters of Thailand.

Ostrea denselamellosa Lischke

Oyster. (Ostreidae). Marine and brackish waters. Japan coast. Found at water depth of 15-40 m. Spawning begins in early June, when the water temperature is about 19°C. Culture by sowing, raft and simplified hanging methods.

Ostrea edulis Linnaeus

European flat oyster. (Ostreidae). Marine and brackish waters. European coast. Cultivated in European countries, specially in Spain, France, Tunisia, Greece, Scotland, Ireland, etc. and Maine (U.S.A.). Culture reported from South Africa also. Salinity tolerance: 24-45 ppt. Spawns at temperature 15-18°C. In cages attains 6-7 cm in 9 months and on ordinary beds 9 cm in 16 months. Feeds on phytoplankton. In Scotland cultivated on ropes attached to floats and reported to attain marketable size in three years.

Ostrea iredalei Faustino

Oyster. (Ostreidae). Marine and brackish waters. Far East. Most important oyster cultivated in Philippines. Ready for harvest when right valves are 6-8 cm or more long. Generally takes 8-12 months to grow from spat to harvesting stage. Harvested before spawning season (March-May).

Ostrea lurida (Carpenter)

Olympia oyster. (Ostreidae). Marine waters. Alaska to lower California on American coast. Cultivated in Puget Sound (U.S.A.) by drilling favourable areas and carefully maintaining the enclosed ground. Begins to spawn when temperature reaches 16°C. Hatchery established in Oregon. Experimental culture in Japan also.

Ostrea madrasensis Preston
Syn. Ostrea gryphoides cuttackensis ?

Backwater oyster. (Ostreidae). Marine and brackish waters. East coast of India. Cultivated in Pulicat Lake (India). Flesh used as food. Food largely diatomaceous. Eggs and larvae prefer low salinities. Salinity range for adults: 8-25 ppt.

Ostrea malabonensis Faustino

Oyster. (Ostreidae). Marine and brackish waters. Far East. Details same as O. iredalei.

Ostrea palmipes Sowarby

Oyster. (Ostreidae). Marine and brackish waters. Far East. Details same as O. iredalei.

Ostrea taurica Krynicki

Oyster. (Ostreidae). Marine waters. Mediterranean. Cultivated in the Black Sea, U.S.S.R.

Ostrea tulipa Lamarck

Oyster. (Ostreidae). Marine and brackish waters. Africa. Experimental cultivation in Nigeria.

Paphia phillipinarus (A. Adams & Reeve)

Clam; tapestry shell. (Veneridae). Marine and brackish waters. Japan coast. Cultivated in Japan. Grows to marketable size of 3 cm in one year.

Pecten laqueatus Sowarby

Window-pane shell. (Pectenidae). Distribution and biological characters similar to P. yessoensis. Cultivated in Japan.

Pecten yessoensis ?

Window-pane shell. (Pectenidae). Marine waters. Japan coast. Generally cold sea dweller. Spawning season March to July. Critical temperature for spawning 8-9°C. Growth depends on location, age and population density.

Perna perna Linnaeus
Syn. Isognomon perna (Linnaeus)

Mussel. (Aviculidae). Marine waters. Limited cultivation on rafts in Venezuela.

Pinctada emarginata ?

Margarita pearl oyster. (Pteriidae). Marine waters. Limited farming in Venezuela.

Pinctada fucata (Gould)

Japanese pearl oyster; pearl oyster of Sri Lanka and Persian Gulf. (Pteriidae). Marine waters. Japan, Red Sea, Sudan, Sri Lanka, etc. Cultivated in Japan. Imported in Australia for experimental culture. Easy to culture, but very small in size. Marketable in five years.

Pinctada margaritifera (Linnaeus)

Black-lip pearl oyster. (Pteriidae). Marine waters. Indo-Pacific. Cultivated for pearls in Japan and Philippines. Treated oysters are put in cages and suspended in sea. Pearl formation in six months, big ones in three years. Cultivated in Australia for flesh and shell also.

Pinctada martensii (Dunker)

Japanese pearl oyster. (Pteriidae). Marine waters. Japan, Sudan, Red Sea, etc. Cultivated for pearls in Japan, in cages suspended in sea. Pearls are formed in six months; big ones in three years. Feeds on diatoms. Cultivated in Australian farms, where pearls are produced in half the time required in Japan (size up to 18 mm diameter). Gigantic nurseries in Sudan and Red Sea-Dongonab Bay.

Pinctada maxima (Jameson)

Silver-lip; Gold-lip; Australian pearl oyster. (Pteriidae). Marine waters. Australasia. Cultivated in seas around Australia. Very much amenable to culture conditions.

Pinctada vulgaris Schum

Indian pearl oyster. (Pteriidae). Marine. Indian seas. Cultivated in the marine farm at Krusadi, India (Bay of Bengal). First spawning in two years. Two spawning periods, one in south west monsoon and the other in north east monsoon. Maximum shell growth attained in third year. Seldom exceeds 8.5 cm in height.

Placuna placenta Linnaeus
Syn. Placenta placenta (Linnaeus)

Window-pane shell. (Anomiidae). Marine and brackish waters. Limited cultivation in Philippine farms. Prefers beds of greyish or bluish mud in tidal zones of estuaries, coves or bays. Shell is free and unattached.

Protothaca staminea Conrad

Little neck clam. (Veneridae). Marine waters. North America. A trend is developing toward private farming in U.S.A.

Pteria penguin (Röding)

Wing shell. (Pteriidae). Marine waters. Far East. Cultivated for pearls in Japan by putting treated oysters in cages and suspending in sea. Pearl formation takes six months to three years according to size required.

Pcynodonta numisma Lamarck

Oyster. (Ostreidae). Marine and brackish waters. Raft culture in Thailand.

Saxidomus giganteus (Deshayes)

Butter clam. (Veneridae). Marine and brackish waters. A trend is developing toward private farming in U.S.A.

Tapes decussatus (Linnaeus)

Mediterranean clam. (Veneridae). Marine and brackish waters. Mediterranean. Young collected from Tunisian coast and fattened in the Bizerta Lake (brackish water). Production in 1967: 85 tons.

Tapes semidecussata Reeve
Syn. Venerupis semidecussata (Reeve)

Japanese little neck clam; Manila clam. (Veneridae). Marine waters. Japan and Pacific coast of Asia. Cultivated in Japan and Korea. Called 'Asari' in Japan. Spawning occurs between 20 and 28°C.

Venerupis japonica Reeve

Manila clam. (Veneridae). Marine waters. Japan coast. A trend is developing toward private farming in Pacific coast of U.S.A.; introduced from Japan.

Venerupis variegata Sowarby
Syn. Tapes variegata (Sowarby)

Short neck clam. (Veneridae). Marine waters. Far East. Cultivated in Korea.

Venus verrucosa Linnaeus

Clam. (Veneridae). Marine and brackish waters. Mediterranean. Young collected from the Tunisian coast and fattened in the Bizerta Lake (brackish water).

Miscellaneous:

Artificial culture of Scallops (Pectenidae), reported in Bay of Peter the Great, off Vladivostok.

Limited cultivation of squids and octopus larvae (exact species determinations not available) has been initiated in Japan.

Certain reports indicate that the undermentioned species are cultivated on a limited scale:

Loligo bleekeri Keferstein (Loliginidae). Experimental culture in Japan.

Octopus vulgaris Cuvier (Octopodidae). Experimental culture in Japan.

Sepia esculenta Hoyle (Sepiidae). Experimental culture in Japan.

9. ECHINODERMATA

Holothuria spp.

Sea cucumber. (Holothuridae). Marine waters. Widely distributed. Artificial culture initiated in Bay of Peter the Great, off Vladivostok.

10. PISCES: TELEOSTOMI

Abramis brama (Linnaeus)[1/]

Bream. (Cyprinidae). Fresh and brackish waters of Europe, off the northwestern part of Asia Minor and in the drainage areas of Caspian and Aral Seas. Introduced in Siberian waters, some lakes of Finland, Poland and Rumania. Artificial propagation in U.S.S.R. Tolerates wide range of salinity. Semi-migratory. Food: detritus, sand and mud particles making up 80-90 percent. Breeds in ponds. Fecundity highly variable. Live eggs and juveniles transported over long distances in U.S.S.R.

Acipenser baeri Brandt

Siberian sturgeon. (Acipenseridae). Rivers of Siberia. Experimental cultivation in Japan ponds; fry imported from Russia are reported to have reached 3-5 kg. Food: larvae of caddis fly, mayfly, black fly and chironomids, carps, burbots, beetles, molluscs, etc. Spawns only once every few years. Fecundity: 174 000-420 000. Slow growth.

Acipenser güldenstaedti Brandt

Russian sturgeon. (Acipenseridae). Basins of Sea of Azov and Caspian Sea. Artificial propagation in U.S.S.R. Generally an anadromous fish. Young feed on benthic invertebrates. Adults feed on amphipods, Cumacea, mysids, chironomids, bullheads, etc. Feeding most intensive during summer. The species has a very fast rate of growth; maximum length: 2.35 m; age: 50-60 years. Becomes mature in 10-20 years.

Acipenser ruthenus Linnaeus[2/]

Sterlet. (Acipenseridae). Rivers in the basins of the Black, Caspian and Baltic seas; basin of the northern Dvina, Arctic Ocean. Introduced to other areas. Cultivated in Rumania. Freshwater fish which migrates upstream for spawning. Insectivore; does not feed in winter. Males mature at 4-5 years and females at 5-9 years. Spawns only once every two or three years. Fecundity: 11 000-137 600. Two races: a European and a Siberian.

Acipenser stellatus Pallas

Starred sturgeon. (Acipenseridae). Basins of Black Sea, Sea of Azov and Caspian Sea. Anadromous fish which enters rivers for spawning. Artificial propagation in U.S.S.R. Larvae feed on chironomids and crustaceans. Adult food: mainly invertebrates. Spawns at an interval of 3-4 years. Males mature in 9-13 years and females in 12-17 years. Fecundity: 20 000-362 000. Maximum size: 220 cm and 68 kg. Maximum age: 30 years.

1/ Successful hybrids: Abramis brama x Scardinius erythropthalmus
Blicca bjoerkna x Abramis brama
Alburnus alburnus x Abramis brama
Alburnus alburnus x Blicca bjoerkna

2/ Hybridization of Acipenser ruthenus with Acipenser güldenstaedti reported to be successful in U.S.S.R.

Acrossocheilus hexagonolepis (McClelland)

Copper Mahseer. (Cyprinidae). Fresh waters of northeast India and Bangladesh, Burma, Malaysia, Malay Archipelago, Thailand, etc. Cultivated in India. Esteemed game fish. Omnivorous feeder. Growth to 15-30 cm and 110 g reported in one year. Attains 60 cm or more in length. Breeds in ponds with running water.

Aegeniosus brevifilis Valenciennes

Mandube. (Siluridae). Fresh waters of South America. Cultivated in ponds in Ceará. Propagation by hypophysation. Larvae extremely cannibalistic. Beneficial in tilapia control.

Alestes imberi Peters

(Characidae). Africa. Experimental culture as larvicidal fish.

Alosa finta (Cuvier)

Twaite shad. (Clupeidae). Mediterranean coasts and Atlantic coast of Europe. Experimental cultivation in Morocco. Marine fish which ascends rivers for spawning. Food: planktonic crustacea, herring larvae, insects, small snails, etc. Very sensitive to pollution.

Alosa sapidissima (Wilson)

American shad; common shad. (Clupeidae). American coast of Atlantic, Pacific coast of North America and Soviet territorial waters of the Pacific Ocean. Ascends streams to spawn, in spring. Food: in sea - chiefly plankton and occasionally young of other fish. Spawned under artificial conditions in North America and eggs and young released into open waters.

Anabas testudineus (Bloch)

Climbing perch. (Anabantidae). Tropical fresh waters of Asia and Far East. Cultivated in Vietnam. Limited culture in other countries. Temperature limits: 20-30°C. Omnivorous feeder. In ponds growth to 12 cm in one year and 20 cm in two years reported. Eggs buoyant, floating freely and yellowish or white in colour. Extensively used for stocking in uncleared waters. Able to live out of water in moist air for six days.

Anguilla anguilla (Linnaeus)

Common river eel. (Anguillidae). European coasts, Mediterranean coast of North Africa. Introduced in other areas. Cultivated in northern Adriatic Sea, fish ponds in the Po region, Belgium, Denmark, France, Greece, Japan, etc. Marine catadromous fish. The eel reaches length of 1.5 m and 6 kg. Food: all kinds of aquatic animals and fish spawn. Farmed in brackishwater ponds, but do not breed in confined waters.

Anguilla japonica Temminck and Schlegel

Japanese eel. (Anguillidae). Japan, China, Vietnam and China (Taiwan). Cultivated in Japan and China (Taiwan). Freshwater catadromous fish. Temperature limits: 20-28°C. Carnivore. Voracious eater in ponds. Growth in one year: 30 cm and 100-200 g. Often reared in association with common carp and grey mullet. Food conversion ratio of 5.5:1, for usual foods, reported. Yields up to 15 000 kg/ha obtained in intensive culture.

Anoplopoma fimbria (Pallas)

Sablefish; black cod. (Anoplopomatidae). South California to Alaska coast. Experimental culture in U.S.A. (Gulf of Georgia). Attains length of over 90 cm. Able to stand very rough treatment and has remarkable recuperative ability. Temperature tolerance: 5-18°C. Salinity tolerance: 21-31 ppt. Grows quickly when conditions are favourable.

Aplocheilus dayi (Steindachner)

Ceylon killifish; Top minnow. (Cyprinodontidae). Sri Lanka fresh waters. Temperature requirement: 20-31°C. Hatching in 12 days at about 25°C. Cultivated as larvicidal fish.

Aplocheilus lineatum (Valenciennes)

Top minnow. (Cyprinodontidae). Fresh and brackish waters of India and Sri Lanka. Breeds at about 8 cm length. Temperature requirement: 20-31°C. Well known larvicidal fish, attaining 10 cm length.

Aplocheilus panchax (Hamilton)

Blue panchax; top minnow. (Cyprinodontidae). Fresh and brackish waters of India, Pakistan, Burma, Sri Lanka, Malaysia, Malay Archipelago, Thailand, etc. Extensive cultivation in Indonesia as larvicidal fish. Breeds at 8 cm, and attains 9 cm length. Temperature tolerance: 21-30°C.

Aplodinotus grunniens Rafinesque

Freshwater drum. (Sciaenidae). Fresh waters of North America. Introduced into Japan for cultivation. Food: mussels, worms, small fish, crayfish and other crustaceans. Prefers quieter waters. Numerous eggs are scattered over the bottom and remain there till hatching.

Arapaima gigas Cuvier

(Arapaimidae). Tropical fresh waters of South America. Cultivated in Brazil. Grows to 4 m and 200 kg. Feeds on invertebrates. Naturally spawns in lakes. Parental care exhibited. Flesh is reported to be very tasty.

Aristichthys nobilis (Richardson)

Big head. (Cyprinidae). Fresh waters of south and central China; introduced into several Far East countries. Cultivated in China, Thailand, Malaysia, Japan, Singapore, Hong Kong, Rumania, Poland, etc. Food: phyto and zooplankton. Growth in two years: 30 cm and 900 g; and in three years: 45 cm and 1.8 kg. Rapid growing fish giving production up to 1 000 kg/ha in manured ponds. Successfully induced to breed by hypophysation.

Astatoreochromis alluaudi Pellegrin
Syn. Haplochromis alluaudi (Boulenger)

(Cichlidae). Fresh waters of Africa. Cultivated in Cameroon, Congo, Kenya and Uganda for bilharzia control as the fish is mallacophagous. Reduction of snails in ponds by 64-96 percent has been obtained. Grows to 16 cm length.

Astronotus ocellatus (Agissiz in Spix)

'Apairi'. (Cichlidae). Fresh waters of South America. Extensively used for culture in Brazil. Naturally spawns in lakes.

Astyanax mexicanus Filippi
Syn. A. fasciatus mexicanus (?)

Banded tetra. (Characinidae). Fresh waters of North America. Cultivated in U.S.A. ponds.

Atherinichthys bonariensis (Cuvier & Valenciennes)

Pejerrey. (Atherinidae). Cultivated in Morocco, Argentina and Brazil.

Auchenoglanis occidentalis Boulenger

(Bagridae). Africa. Omnivorous with predatory tendency. Sexual maturity at age of two years. Mixed culture with tilapia.

Bagrus bayad Forskål

'Valefo'. (Bagridae). Fresh waters of North Africa. Cultivated in Ghana. Bottom feeder, consuming plants and fish (prawns in deeper waters and fin-fish in shallow areas). Molluscs and insect larvae are also consumed. Does not often breed in small ponds, but breeds well in reservoirs.

Bagrus docmac (Forskål)

'Valefo'. (Bagridae). Fresh waters of Africa. Cultivated in Ghana. Main food: fish eggs, fry, adult fish, molluscs and insect larvae. Does not breed in ponds; breeds well in large reservoirs. Juveniles are known to live and feed among exposed rocks and disperse to the open waters later. In rivers, change from insectivorous to piscivorous habit is observed from 20 cm length onward. In Lake Victoria the fish is reported to depend entirely on Haplochromis for its food, from 15 cm length onward.

Barbus aureus (Cope)

Barbel. (Cyprinidae). Fresh waters of Umvoti, Natal, etc. (Africa). Propagated in South Africa for stocking rivers. Attains length of 20 cm.

Barbus caudovittatus Boulenger

Barbel. (Cyprinidae). Fresh waters of Ubanghi, Africa. Experimental cultivation in Leopoldville, Zaire. Attains length of 9 cm. Does not spawn in ponds.

Barbus grypus Heckel

Barbel. (Cyprinidae). Fresh waters of Euphrates and Tigris. Experimental cultivation in Republic of Iraq, separately or in combination with common carp. Herbivorous fish.

Barbus holubi Steindachner

Small-mouth yellowfish. (Cyprinidae). Fresh waters of South Africa. Propagated for introduction into lakes. Reported to have bred and established in Lake Kyle, Rhodesia.

Barbus luteus Heckel

Barbel. (Cyprinidae). Fresh waters of Orontes, Euphrates and Khaboin rivers. Experimental cultivation in Republic of Iraq, separately or in combination with common carp. Breeds in May-June. Herbivorous fish.

Barbus occidentalis Boulenger

Barbel. (Cyprinidae). Fresh waters of Lagos: Ogun river, Upper Niger, etc. Experimental cultivation in Nigeria. Attains length of 8 cm.

Barbus paludinosus Peters

Barbel. (Cyprinidae). Africa. Experimental culture as larvicidal fish.

Barbus spharpeyi Günther

Barbel. (Cyprinidae). Euphrates river. Experimental cultivation in Republic of Iraq, separately or in combination with common carp.

Barbus trimaculatus Peters

Barbel. (Cyprinidae). Africa. Experimental culture as larvicidal fish.

Barbus xanthopterus (Heckel)

Barbel. (Cyprinidae). Euphrates river. Experimental cultivation in Republic of Iraq, separately or in combination with common carp.

Brycon guatemalensis (Günther)

'Sabalo'. (Characinidae). Cultivated in Guatemala. 3-159 kg/ha/year from ponds reported.

Brycon henni Eigenmann

Sabaleta. (Characidae). Fresh waters of South America. Experimental culture in ponds in Colombia.

Caranx delicatissimus (Döderlein)

Striped jack; shimaaji. (Carangidae). Coast of middle Japan and southward. Spawns in June and July. Most expensive food fish among the carangids. Experimental culture in Japan.

Carassius auratus (Linnaeus)

Goldfish; silver crucian carp. (Cyprinidae). Widely distributed. Cultivated in China, Japan, Vietnam, Indonesia, Hong Kong, France, Rumania, U.S.S.R., Thailand, India, Pakistan, etc. Generally grown in tropical waters between 200 and 1 000 m above sea level. Omnivorous feeder, preferring lower water plants and small insect larvae. The fish spawns in captivity. In most cases goldfish is propagated for aquaria and as forage fish. In manured ponds the average production has been estimated to be 400 kg/ha.

Carassius auratus gibelio (Bloch)

European goldfish. (Cyprinidae). Artificially propagated in U.S.S.R. hatcheries.

Carassius carassius (Linnaeus)

Crucian carp; English carp; golden carp. (Cyprinidae). Temperate waters of Europe. Freshwater fish, introduced in many countries. Cultivated in Europe, Japan, India, North Borneo, China, Indonesia, China (Taiwan), Rumania, etc. Plankton and detritus feeder. Breeds when 10-13 cm long. Fecundity: 300 000. Incubation period: 5-7 days. Breeds in

confined waters. Suitable for culture in paddy fields. Average growth reported to be 20–25 cm in one year in tropical waters and 10 cm in one year in temperate regions.

Catla catla (Hamilton)

Catla. (Cyprinidae). Tropical fresh waters of India, Pakistan and Burma. Introduced in many countries. Cultivated in India, Pakistan, Burma, Sri Lanka, Israel, Malaysia, Japan, etc. Able to tolerate slightly brackish water. Plankton feeder. A fast growing fish attaining 38–45 cm and 900 g in one year and 4–5 kg in two years. Annual production in fertile ponds estimated to be 1 100–2 200 kg/ha. Eggs spherical and transparent, 2 mm in diameter, increasing to 4–5 mm when hydrated. Hatching takes place in 16–18 hours. Artificial propagation by hypophysation very successful in India.

Catostomus commersonii (Lacépède)

White sucker. (Catostomidae). Fresh waters of North America. Cultivated in North America. Prefers clear water. Food: aquatic plants, insects, worms and molluscs. Average growth estimated to be 6 cm, 10 cm, 14 cm, 18 cm, 20 cm, and 25 cm, in the first six years respectively. Upstream migration for spawning, with general preference to shallow waters. Eggs normally buried in loose gravel. Fecundity: 22 000–100 000. Eggs stripped and hatched in jars. Fry are stocked in fertilized ponds and reared to marketable size without supplementary feeding. The fish is used as bait for Esox lucius.

Centropomus parallelus Poey

Camurim. (Centropomidae). South America. Cultivated in brackishwater ponds in Brazil. Carnivorous.

Centropomus undecimalis Bloch

Camurim. (Centropomidae). South America. Cultivated in brackishwater ponds in Brazil. Predatory fish.

Chalcalburnus chalcoides Güldenstaedt

Shemaia. (Cyprinidae). Basins of the Black Sea, Sea of Azov, Caspian and Aral Seas. Cultivated in middle and southern states of U.S.S.R. Artificial spawning in hatcheries. Plankton feeder. Very sensitive to purity of water. When water is turbid spawning is halted and eggs and larvae die. Existence of 'homing instinct' indicated. A number of subspecies determined.

Chanos chanos (Forskål)

Milkfish. (Chanidae). Indo-Pacific seas. Cultivated in Indonesia, Philippines, Thailand, Malaysia, China (Taiwan), Hawaii, Burma, Pakistan, India, Sri Lanka, etc. Able to tolerate wide ranges in salinity and even fresh water. Temperature tolerance: 15–40°C. Herbivorous, but may consume smaller quantities of animal matter. Average growth estimated to be 5–7 cm in one month, 12–15 cm in two months and 40 cm and 450 g in one year. Production in brackish waters reported to be up to about 2 000 kg/ha. Spawns in the sea near the coast. Eggs pelagic, about 12 mm in diameter. A fish of commercial importance in the development of coastal aquaculture.

Chirostoma estor Jordan

'Pescado Blanco'. (Atherinidae). South America and Mexico. Cultivated in Mexico for restocking purposes.

Chirostoma grandocule Steindachner

Charal. (Atherinidae). South America and Mexico. Cultivated in freshwater ponds.

Chirostoma bartoni Jordan & Evermann

Charal. (Atherinidae). South America and Mexico. Cultivated in freshwater ponds.

Chrysichthys longibarbis Boulenger

(Bagridae). Africa. Experimental culture. Survival rate and growth have been poor.

Chrysichthys nigrodigitatus (Lacépède)

(Bagridae). Upper Niger, Gold Coast, Cameroon. Cultivated in Ghana. Can live both in lagoons and fresh waters. Bottom feeder, the common food items being molluscs and prawns. Do not generally breed in ponds.

Chrysichthys walkeri Günther

(Bagridae). Portuguese Guinea; Sierra Leone to Ogowe. Cultivated in Ghana. Other details same as C. nigrodigitatus.

Chrysophrys major (Temminck & Schlegel)

'Genuin porgy'; madai. (Sparidae). Shore fish in Japan, South Korea, Formosa and in East and South China Seas. Extensive and experimental cultivation in Japan and Korea respectively. Carnivorous. Spawning migration to shallow waters in April and May. Sexually mature at three years.

Cichla ocellaris Bloch & Schneider

'Tucunare commun'. (Cichlidae). South America. Cultivated in Brazil. Carnivorous. Naturally spawns in lakes. Spawning is preceded by long courtship.

Cichla tamensis Gumboldt

'Tucunare pinima'. (Cichlidae). South America. Artificial propagation and extensive cultivation reported from Brazil. Naturally spawns in lakes. Predatory fish.

Cichlasoma dovii (Günther)

'El Lagunero'. (Cichlidae). Amazon region. Cultivation in ponds. Benthophagic species. Digs nest-holes in the bottom of ponds for depositing the eggs, which the parents guard.

Cichlasoma festivum Heckel

Vieja. (Cichlidae). South America. Grown in natural ponds ('chameras') which are temporarily flooded by rivers.

Cichlasoma guttulatum (Günther)

'Mojarra azul'. (Cichlidae). Amazon region. Cultivated in Guatemala ponds. Benthophagic. Digs nest-holes in the bottom of ponds. Maximum production reported from ponds: 107 kg/ha/year.

Cichlasoma macracanthus (Günther)

'Mojarra negra'. (Cichlidae). Amazon region. Cultivated in Guatemala ponds. Other details same as C. guttulatum.

Cichlasoma managüense (Günther)

'Guapote tigre'. (Cichlidae). Amazon region. Cultivated in Guatemala ponds. Other details same as C. guttulatum; with a reported maximum production of 186 kg/ha/year from ponds.

Cichlasoma motagüense (Günther)

'Istatagua'. (Cichlidae). Amazon region. Cultivated in Guatemala ponds. Production from ponds: 45-239 kg/ha/year. Other details same as C. guttulatum.

Cirrhina cirrhosa (Bloch)

White carp. (Cyprinidae). Fresh waters of south India. Cultivated in south Indian ponds. Hardy fish growing to 25-30 cm and 330 g in one year and 61 cm in two years. Plankton feeder, which also browses on algae in marginal areas. Sexually mature when 20-25 cm long. Does not breed in ponds.

Cirrhina molitorella (Cuvier & Valenciennes)

Mud carp. (Cyprinidae). Fresh waters of south and central China; introduced in Thailand, Malaysia and other countries. Cultivated with other species in China, China (Taiwan), Thailand, Malaysia, Japan and Hong Kong. Serves as scavenger in ponds. Omnivorous feeder. Grows to 3-8 cm and 25-75 g in one year, 25 cm and 300 g in two years and 30 cm and 600 g in three years. Maximum weight: about 900 g. Does not breed in ponds.

Cirrhina mrigala (Hamilton)

'Mrigal'. (Cyprinidae). Fresh waters of India, Pakistan and Burma. Cultivated in India, Pakistan, Malaysia, Japan, etc. Bottom feeder; omnivore. Grows to 24 cm and 340 g in 6 months and 45-61 cm and 1-2 kg in one year. The average growth in ponds has been estimated to be 38-41 cm in one year. Does not breed in ponds. Induced breeding by hypophysation has been very successful in India.

Cirrhina reba (Hamilton)

'Reba'. (Cyprinidae). Fresh waters of India and Pakistan. Cultivated in ponds in India. Plankton and detritus feeder. Growth fairly rapid. Grows to about 30 cm in natural waters. Does not breed in ponds. Induced breeding by hypophysation successful in India.

Citharidium ansorgei Boulenger

(Citharinidae). Fresh waters of Africa. Cultivated in Nigeria. Detritus feeder. Does not spawn in ponds.

Citharinus citharus (Geoffroy)

Moonfish. (Citharinidae). Fresh waters of tropical central Africa. Cultivated in Congo and Nigeria. Detritus feeder. Does not spawn in ponds. Spawns in swamps during August-September. Grows to 10-13 cm in two months and 20-30 cm in one year.

Citharinus congicus Boulenger

(Citharinidae). Fresh waters of Upper Congo. Cultivated in Congo. Detritus feeder. Does not breed in ponds. Grows to 50 cm.

Citharinus gibbosus Boulenger

(Citharinidae). Fresh waters of Africa. Cultivated in Congo. Detritus feeder. Does not breed in ponds.

Clarias batrachus (Linnaeus)

Catfish. (Claridae). Freshwaters of Indo-Pacific region. Cultivated in India, Pakistan, Malaysia, Khmer, etc. Cage culture in Thailand. Able to tolerate slightly brackish waters. Food: worms, insects, shrimps and decayed animal matter. Grows to about 20 cm in one year. Spawns in ponds. Parental care exhibited in ponds. Generally considered as extraneous fish in ponds and rice fields in some of the countries.

Clarias lazera Cuvier & Valenciennes

(Claridae). Africa. Mixed culture with tilapia as well as monoculture. Growth rate very fast. Omnivorous. Sexual maturity in 10 months.

Clarias macrocephalus Günther

Catfish. (Claridae). Cultivated in Thailand freshwater ponds. Considered to be highly delicious. Fry feed on zooplankton; adults on: worms, insects, shrimps, etc. Breeds during rainy season in paddy fields. Induced to breed by hypophysation. Optimum stocking rate: 50 fingerlings (7-10 cm) per m^2. Average growth reported to be about 40 g/month when fed with animal offal mixed with rice and vegetables. Harvestable length of 25 cm attained in 4-5 months.

Clupea harengus Linnaeus

Oceanic herring. (Clupeidae). Boreal and sub-tropical waters of the northern parts of Atlantic and Pacific Oceans. Experimental rearing of larvae up to the stage after metamorphosis, in German and Norwegian coasts. Marine, pelagic, shoal fish, which reaches a maximum length of 50 cm.

Clupea pallasi Valenciennes

Pacific herring. (Clupeidae). Pacific Ocean; Asiatic coast from Korea to Lena estuary in U.S.S.R. and American coast. Experimental rearing of larvae up to 40 days, with survival of 14 percent reported from North America.

Coregonus albula (Linnaeus)

Ripus; Baltic or European Cisco, Lake whitefish. (Coregonidae). Marine, brackish and fresh waters from Ireland to basin of Baltic Sea (U.S.S.R.) and Volga Basin. Artificial propagation in U.S.S.R. Plankton feeder, the food items being mainly crustaceans. Feeds intensively during summer. Grows up to 46 cm length.

Coregonus clupeaformis (Mitchill)

Lake whitefish. (Coregonidae). Fresh waters of North America. Artificial propagation in U.S.A. and Canada. Food: plankton, aquatic insect larvae, bottom organisms and occassionally small fish. Spawning in November-December, the female scattering the eggs over rocky or sandy areas. Spawners three or more years old. Fecundity: 10 000-75 000 or more. Stocking of fry in many continent waters not successful.

Coregonus lavaretus (Linnaeus)

Common whitefish. (Coregonidae). Migratory river fish, from Switzerland to Kolyma river in U.S.S.R. Cultivated in U.S.S.R. Many sub-species determined in U.S.S.R. (C. lavaretus baeri Kessler, C. lavaretus pidschian (Gmelin), C. lavaretus ludoga Poljakow, etc.).

Coregonus lavaretus maraena Bloch

Whitefish. (Coregonidae). Fresh waters of Europe. Cultivated in ponds, especially deep dam-valley ponds, in Czechoslovakia. Successfully propagated in cold waters. General temperature preference: about 25°C.

Coregonus nasus (Pallas)

Broad whitefish. (Coregonidae). Lake-river fish in Siberia and North America. Cultivated in northern U.S.S.R. waters. Largest of all whitefish, growing up to about 16 kg. Bottom feeder, feeding on chironomid larvae, small molluscs and benthic crustaceans. Fecundity: 34 000-134 000.

Coregonus peled (Gmelin)[1/]

Peled; 'Syrok'. (Coregonidae). Lake-river fish in U.S.S.R. (from Mezen river in the west to Kolyma river in the east). Cultured successfully in carp ponds in the north and Ukraine (U.S.S.R.). Attains 50 cm and 5 kg. Primarily zooplankton feeder, the important food item being pelagic crustaceans. Sexually mature in 3-5 years. Spawning takes place in river channels on gravelly or sandy ground. Temperature tolerance: 21-26°C.

Ctenopharyngodon idellus (Cuvier & Valenciennes)

Grass carp; 'White amur'. (Cyprinidae). Fresh waters of China. Introduced in several countries. Cultivated in China, Japan, Russia, India, Vietnam, Thailand, Malaysia, Sri Lanka, China (Taiwan), Burma, Hong Kong, Philippines, Singapore, Yugoslavia, Hungary, Rumania, etc. Able to tolerate slightly brackish waters. Omnivorous feeder, but adults are considered to be very useful for controlling aquatic weeds. Fry feed on: Cyclops, Diaptomus, Daphnia, etc., changing to Lemna and other aquatic weeds in later stages. General average growth: 15-30 cm and 225-650 g in one year and 60 cm and 1.8-2.3 kg in two years. Does not breed in confined waters. Induced breeding by hypophysation has been successful in many countries.

Cynoscion nebulosus (Mitchill)

'Trout'. (Sciaenidae). North American coast. Occur along with other fishes in earthen brackishwater ponds in South Carolina, U.S.A. Marine fish which can tolerate brackish waters up to salinity of 20 ppt. Carnivorous fish.

Cyprinus carpio (Linnaeus)[2/]

Common carp; European carp; German carp; wild carp. (Cyprinidae). Native to China and U.S.S.R., transplanted in the middle ages to Europe and Asian countries. Cultivated in freshwater impoundments all over the world. Cage culture on commercial scale in Japan.

1/ Hybrid of C. peled and C. lavaretus maraenoides Poljakow under experimental cultivation in U.S.S.R. carp ponds.

2/ Hybrid of Cirrhina molitorella (Cuvier & Valenciennes) and Cyprinus carpio under experimental cultivation in China (Taiwan).

Temperature tolerance: generally 20–25°C. Omnivore; mostly bottom feeder. Average growth to 1 kg in one year and 2 kg in two years. Production: 500–600 kg/ha in India; 1 000 kg in Indonesia; 2 000–5 000 kg in Japan. Breeds in confined waters. Eggs creamy yellow, 1.5–2 mm in diameter; adhesive. Several varieties and numerous sub-varieties have been determined.

Diapterus rhombeus Cuvier

Carapeba. (Cichlidae). South America. Cultivated in brackishwater ponds in Brazil. Grows to 15 cm.

Dicentrarchus labrax (Linnaeus)
Syns. Morone labrax (Linnaeus) and Labrax lupus (Lacépède)

Sea bass. (Serranidae). North Adriatic Sea, Black Sea (U.S.S.R.), etc. Cultivated in marine and brackishwater ponds in the Po region and Black Sea region. Voracious eater of fish, particularly sardines. Spawning takes place in sea and estuarine waters from May to August. Does not breed in ponds.

Dicentrarchus punctatus Bloch
Syn. Morone punctata (Bloch)

Black spotted bass; bar tachete. (Serranidae). Mediterranean and coasts of Atlantic from Normandy to Senegambia. Experimental culture in France. Strict carnivore. Artificial feeds: crustaceans and molluscan juice. Grows to 36 cm.

Distichodus fasciatus Boulenger

(Citharinidae). Lake Tamlea (Africa). Cultivated in freshwater ponds in Zaire. Predatory fish; periphytophagic and detritophagic. Does not spawn in ponds.

Distichodus maculatus Boulenger

(Citharinidae). River Sankuru, Kasai (Africa). Cultivated in freshwater ponds in Congo. Other details same as D. fasciatus.

Dormitator latifrons Richardson

Chame. (Gobiidae). South America. Grown in 'chameras'.

Eleutheronema tetradactylum (Shaw)

Threadfin. (Polynemidae). Indo-Pacific seas. Cultivated in brackishwater impoundments in India and Pakistan. Ascends higher up the rivers than others of the family. Predatory fish, the food items being fishes, prawns, mysids, amphipods, isopods, stomatopods, and crustacean remains. Grows to average length of 19 cm in one year and 37 cm in two years. Breeding takes place in the sea, with an extended spawning period.

Elops hawaiensis Regan

Ten-pounder. (Elopidae). Seas of Java, Malaysia, China (Taiwan) and Hawaii. Extraneous fish in brackishwater ponds in Indonesia. Maximum length about 1 m. Found in seas and estuaries, but occasionally enter rivers also. Mainly planktophagic.

Elops machnata (Forskål)

Ten-pounder. (Elopidae). Red Sea, Indian Seas to China and Japan. Cultivated in brackishwater ponds of Hawaii along with milkfish, mullets and tarpon. Food: carnivorous, feeding mainly on fish and crustaceans.

Elops saurus Linnaeus

Ten-pounder. (Elopidae). Indo-Pacific seas, east coast of Africa, Red Sea, etc. Suitable for cultivation in brackish waters. Acclimatized to freshwater conditions in India. Food: small fish and crustaceans. Breeding takes place in the sea.

Epinephelus sp.

'Rock cod'. (Epinephelidae). Tropical fish; ranges from middle of Japan southward to China Sea and Java. Experimental cultivation in Hong Kong and Singapore.

Esox lucius Linnaeus

Pike; Northern pike. (Esocidae). Fresh waters of Europe, Siberia and North America. Cultivated in Europe, U.S.S.R. and U.S.A. Experimental in Madagascar also. In Nebraska (U.S.A.) the economic feasibility of rearing the fish in small drainable ponds is under trial. Excellent sport fish. Predatory fish. Grows to more than 1.5 m and 35 kg. Fecundity: 100 000–1 000 000.

Esox masquinongy Mitchill

Muskellunge. (Esocidae). Larger freshwater bodies of North America. Cultivated in Morocco and U.S.A. Hatchery propagation reported from U.S.A. since 1890. Hatchery stocked population established in Niger creek, Ontario. Carnivorous fish, feeding on suckers, perches, minnows, etc. Sometimes cannibalistic. Prefers to lie in concealed spots, weed beds, etc. Grows to about 22 cm, 39 cm, 53 cm, 66 cm, 76 cm and 86 cm in first six years respectively. Artificial propagation by stripping.

Etroplus suratensis (Bloch)

Pearlspot; freshwater pomfret. (Cichlidae). Fresh and brackish waters along coast of India and Sri Lanka. Cultivated in Indian ponds. Advanced fry feed on aquatic insect larvae, filamentous algae and other plants; juveniles feed on zooplankton also. The adult is essentially a vegetable feeder, consuming filamentous algae, aquatic plants and phytoplankton. In ponds reported to attain 10–12 cm and 113 g in one year. Breeds naturally in ponds. Reported to become sexually mature in second year. Fecundity: 1 300–6 000. The female guards fertilized eggs.

Eutropius depressirostris Peters

(Schilbeidae). Africa. Experimental culture as larvicidal fish.

Evynnis japonica Tanaka

Crimson sea bream. (Sparidae). Japanese coast. Spawning season from September to November. Grows to about 40 cm. Experimental cultivation in Japan.

Fugu rubripes (Temminck & Schlegel)

Tiger puffer. (Tetraodontidae). Japanese coast. Extensively cultivated in Japan. Grows to 70 cm or more. Used as food in Japan; cooking is done especially in removing the ovary and blood which contain a poisonous substance called tetrodotoxin.

Gadus morhua Linnaeus

Cod. (Gadidae). North Atlantic along American and European coasts. Artificial propagation in Norway. Mature fish caught in January to February and kept in spawning ponds. When temperature is favourable, spawning takes place and the fertilized eggs concentrate on the surface and are collected once a day and transferred to special incubators containing sea water. Survival rate of larvae: up to 90 percent. Every year 100–150 million larvae are released in Oslofjord. The fish grows rapidly and span of life is about 17 years. Feeds mainly on fish fry, Euphausiidae, Hyperiidae and benthic invertebrates.

Gambusia affinis affinis (Baird & Girard)

Mosquito fish; spotted Gambusia. (Poeciliidae). Gulf drainage from Texas to Alabama, North America; introduced in many countries. Cultivated in different countries for controlling mosquitoes. Hardy fish, which can stand all types of foul water conditions, poor food, overcrowding, etc. Temperature tolerance: above freezing point to 33°C. Reported to consume mosquitoes equal to its own weight per day.

Gambusia affinis holbrooki (Girard)

Mosquito fish. (Poeciliidae). New Jersey to Florida (U.S.A.). Introduced in California, Burma, Thailand, India, Hawaii, Tahiti, China (Taiwan), Philippines, Japan, Ghana, Madagascar, etc., for cultivation mainly as larvicidal fish, for malaria control. Temperature tolerance above freezing point to 32°C. Hardy fish which grows to about 5 cm. In winter the fish hibernates in mud. One specimen may consume about 165 mosquito larvae in two hours. Breeds in four months, depending on water temperature and food supply.

Gymnarchus niloticus Cuvier

(Gymnarchidae). Fresh waters of Nile basin and West Africa. Experimental cultivation in Cameroon and Nigeria. Adults feed on fish. Grows to about 2 m. Fecundity: 1 000. Prior to spawning the female constructs a floating nest of water plants, where the eggs are deposited. The male protects the nest during incubation. Larvae have a large yolk sac and external gills.

Haplochromis carlottae (Boulenger)

(Cichlidae). Fresh waters of Zambesi, Africa. Cultivated in ponds in Central East Africa. Carnivorous fish, feeding mainly on water snails. Mouth breeder, eggs and fry being carried by the female.

Haplochromis mellandi (Boulenger)

(Cichlidae). Fresh waters of Zambesi, Africa. Cultivated in small reservoirs of Zambia. Also in Zaire for bilharzia control, as the fish consume molluscs in ponds and rice fields. Mouth breeder, eggs and fry being carried by the female.

Helostoma temmincki Cuvier & Valenciennes

Kissing Gourami. (Helostomidae). Fresh waters of Java, Sumatra, Borneo, Malaysia, Indonesia, etc. Cultivated in Indonesia, Malaysia, Thailand, Sri Lanka and South Vietnam. Cage culture in Thailand. Temperature preference: 25–30°C. Mid-water and surface feeder, consuming plankton, mostly phyto. Resistant to low oxygen tension. Breeds in ponds if appropriate measures are taken. Annual production up to 500 kg/ha. Maximum size: 30 cm.

Hemichromis bimaculatus Gill

Jewelfish. (Cichlidae). Fresh waters and estuaries of West Africa. Cultivated in Ghana. Generally used as a laboratory animal. Maximum size: 10 cm. Temperature tolerance: 21-30°C. Fecundity: about 300.

Hemichromis fasciatus Peters

Jewelfish. (Cichlidae). Fresh waters of North and West Africa and estuaries of West Africa. Cultivated in Cameroon, Zaire, Ivory Coast, Upper Volta, etc. for tilapia control. Grows up to 25 cm. Breeds when about 15 cm long. Temperature tolerance: 21-30°C.

Hepsetus odoë (Bloch)

(Characinidae). Lake Tamba (Congo). Experimental cultivation in Cameroon.

Heterobranchus longifilis Cuvier & Valenciennes

(Claridae). Africa. Experimental mixed culture with tilapia.

Heteropneustes fossilis (Bloch)

Catfish. (Heteropneustidae). Tropical fresh waters of India, Pakistan, Sri Lanka, Burma, Thailand and Khmer. Primarily a fish of ponds, ditches, swamps and marshes. Cultivated in India and Pakistan. Able to tolerate slightly brackish waters. Omnivorous, bottom feeder. Growth in first year estimated to be 20 cm. Breeding season prolonged. Air breathing fish and hence able to survive in mud and even out of water if body is kept moist. Great demand because of its medicinal value.

Heterotis niloticus Cuvier

(Heterotidae). Fresh waters of Africa. Cultivated in Cameroon, Central African Republic, Congo, Ivory Coast, Madagascar, Nigeria, Togo, etc. Nest built from vegetation. Larvae with external gills.

Hilsa ilisha (Hamilton)

Indian shad; hilsa. (Clupeidae). Foreshore areas, estuaries, brackishwater lakes and rivers of the West Indo-Pacific region. Experimental cultivation in India. Artificial propagation by stripping. Hatchlings have grown to 16 cm average length (range: 13-23 cm) in one year. Food: zoo and phytoplankton. Young and adult reported to feed at the bottom as well.

Hucho hucho (Linnaeus)

'Huchen'. (Salmonidae). River Danube. Experimental cultivation in Morocco; also cultivated in Austria and Czechoslovakia. Immature fish feed on invertebrates, but from second year start feeding on fish. Spawns during spring, in natural waters, on gravelly ground. Grows to 15 cm in one year and 150 cm in 15 years.

Hydrocyon brevis Günther

Tigerfish. (Characinidae). Fresh waters and estuaries of West Africa. Cultivated in Ghana. Carnivorous fish, suitable for control of other fish and also as food fish. Very good swimmer and has very powerful teeth.

Hydrocyon forskali Cuvier

Tigerfish. (Characinidae). Fresh waters of Nigeria and Portuguese Guinea. Cultivated in Ghana. Other details same as H. brevis.

Hydrocyon vittatus Castelnau

Tigerfish. (Characinidae). Fresh waters of West Africa. Experimental cultivation in Mozambique.

Hypomesus olidus (Pallas)

Pond smelt. (Osmeridae). River fish, inhabiting fresh waters and estuaries, in Japan and Siberia. Cultivated in Japan. Feeds mostly on dipteran insects. Spawns in rivers from January to March. Fecundity: 1 179-3 836. Artificial propagation by stripping. Fertilized eggs shipped over long distances.

Hypophthalmichthys harmandi Sauvage

'Ca duong; Ca coc'. (Cyprinidae). Freshwater river fish of Vietnam and Laos. Cultivated in Vietnam in association with common carp, Labeo collaris and Mylopharyngodon aethiops, providing the main part of stock. Plankton and detritus feeder. Does not breed in ponds. Fry collected from rivers and transported over long distances.

Hypophthalmichthys molitrix (Valenciennes)

Silver carp. (Cyprinidae). Fresh waters of China; introduced in several countries. Cultivated in many countries like China, China (Taiwan), Thailand, Malaysia, Japan, Sri Lanka, India, Pakistan, Nepal, Philippines, U.S.S.R., Burma, Hong Kong, Singapore, Egypt, etc. Able to tolerate slightly brackish waters. Plankton feeder, consuming both phyto and zooplankters. Grows to about 12.1 cm in one year, 25.6 cm in two years, 34.2 cm in three years and 41.4 cm in four years. Does not breed in ponds. Induced breeding by hypophysation followed by stripping has been successful. Reared generally in association with other species. Maximum annual production in manured ponds reported to be about 1 000 kg/ha.

Ictalurus catus (Linnaeus)

White catfish. (Ictaluridae). Fresh waters of Pennsylvania south to Texas (U.S.A.). Also found in estuaries of the region. Introduced to other areas in U.S.A. Cultivated in commercial farm ponds in U.S.A. Grows to about 450-675 g.

Ictalurus furcatus (Lesueur)[1/]

Blue catfish. (Ictaluridae). Lakes and rivers of North America. Experimental cultivation in brackish waters in Mexico, U.S.A. Feeds on practically anything that it can ingest. Mostly nocturnal bottom feeder. Spring spawner and migrates in spring upstream and in autumn downstream.

Ictalurus melas (Rafinesque)

Black bullhead. (Ictaluridae). Fresh waters of North America. Cultivated in fish ponds in Iowa (U.S.A.).

1/ Hybrid of Ictalurus punctatus and I. furcatus has shown considerable promise. In 225 days the hybrid outgrew the parents by 15 and 65 percent respectively.

Ictalurus meridionalis Günther

Bagre. (Ictaluridae). North America and Mexico. Cultured in ponds.

Ictalurus natalis (Lesueur)

Yellow bullhead. (Ictaluridae). Fresh waters of North America. Artificially propagated in U.S.A. Food: worms, crustaceans, and fish are the preferred items, but can consume anything that it can ingest. Able to live in stagnant, polluted and muddy waters. Can also live out of water for long time. Spawns in late spring and early summer and extreme care is taken for preparation of the nest, which is built by both male and female.

Ictalurus nebulosus (Lesueur)

Square-tail catfish. (Ictaluridae). Rivers of U.S.A., U.S.S.R., etc. Descends into brackish water during the high water of the winter and spring. Cultivated in farm ponds in Alabama (U.S.A.). Food: chironomids, Trichoptera, molluscs and small quantities of fish.

Ictalurus nebulosus marmoratus (Holbrook)

Southern brown bullhead; speckled bullhead; red cat. (Ictaluridae). Fresh waters of North America. Cultivated in freshwater ponds in U.S.A. Readily feed on minnows, crayfish, worms, etc., but take any item that can be ingested. Able to survive out of water for an extremely long time. Can live in stagnant, polluted and shallow muddy waters. While not strictly a schooling fish, it is gregarious and generally many numbers are found together. Breeds in late spring and early summer. Nest site is in water less than 1 m in depth and protected from strong currents. Great care is taken by the parents in building the nest. Production: 214-319 kg/ha with fertilization; 1 652-1 932 kg/ha with fertilization and supplementary feeding with soyabean meal and cake. Minimum marketable size: 340-450 g.

Ictalurus punctatus (Rafinesque)

Channel catfish. (Ictaluridae). Great Lakes and Mississippi Valley of U.S.A. Introduced in Atlantic and Pacific coasts and Europe. Cultivated in freshwater ponds in U.S.A. Experimental culture in brackish waters in Mexico. Feeds on various animal and plant material. Best method for rearing channel catfish has been found to release hatched fry direct into ponds. Breeding in open ponds with spawning receptacles; in pens kept in holding ponds; in milk cans and terra cotta pipes; and by hypophysation. Fecundity: about 8 800 per kg body weight. Production up to 2 423 kg/ha has been obtained in 252 days at stocking rate of 4 942 fingerlings per ha and supplementary feeding with pellets.

Ictiobus bubalus (Rafinesque)[1/]

Small mouth buffalo. (Catostomidae). Fresh waters of North America. Cultivated in U.S.A. ponds. Benthophagic. Cultured in rotation with rice. Stocked at 125-250/ha, reach marketable size in two years: production rate being 300-400 kg/ha/year. Spawns in spring and first half of summer, generally on submerged vegetation in backwaters during river overflows.

1/ Ictiobus niger x I. bubalus and I. bubalus x I. cyprinellus hybrids successfully produced and cultivated in ponds. They showed accelerated growth rates.

Ictiobus cyprinellus (Valenciennes)[1/]
Syn. Megastomatobus cyprinellus (Valenciennes)

Bigmouth buffalo. (Catostomidae). Fresh waters of central U.S.A. Cultivated in freshwater ponds in U.S.A. Stocking rate of brood fish in wintering ponds: 450–675 kg/ha; for fertilized ponds: 1 100–2 250 kg/ha. Other details same as I. bubalus.

Ictiobus niger (Rafinesque)

Black buffalo. (Catostomidae). Fresh waters of U.S.A. Cultivated in ponds in U.S.A. Details same as I. bubalus.

Labeo bata (Hamilton)

Bata. (Cyprinidae). Fresh waters of India and Pakistan. Cultivated along with Indian major carps in India and Pakistan. Omnivorous. Feeds on phyto and zooplankton, filamentous algae and small animals. Does not breed in ponds. Induced breeding by hypophysation successful in India.

Labeo calbasu (Hamilton)

Calbasu. (Cyprinidae). Fresh waters of India, Pakistan, Burma and Thailand. Cultivated in association with other species in India, Pakistan, and Burma. Able to tolerate slightly brackish water. Omnivore, detritus feeder. Does not breed in ponds. Induced breeding by hypophysation. Egg: 5–6 mm diameter, bluish, demersal and non-adhesive. Growth in first year: 30–35 cm and 450 g.

Labeo collaris Nichols & Pope

(Cyprinidae). Fresh waters of Vietnam, Laos and China. Cultivated in association with Hypophthalmichthys harmandi and Mylopharyngodon piceus in Vietnam. Omnivore; mainly plankton feeder. Adult mid-water feeder. Does not breed in ponds.

Labeo coubie Rüppell

(Cyprinidae). Fresh waters of North Africa. Cultivated in ponds in Ghana. Grows up to 45 cm in length. Breeds in ponds.

Labeo fimbriatus (Bloch)

Fringe-lipped carp. (Cyprinidae). Cultivated in ponds, along with other carps in India. Mainly a herbivore at the river bottom and pockets in shallow marginal areas. The main food items are Bacillariaceae, Chlorophyceae, Myxophyceae, macrovegetation, animal matter and decayed organic matter. Grows to about 23 cm and 450 g in one year and 31 cm in two years. Does not breed in ponds.

Labeo gonius (Hamilton)

(Cyprinidae). Fresh waters of India, Pakistan and Burma. Cultivated in ponds in Assam (India). Artificial propagation by hypophysation and 'bundh breeding'. Does not breed in ponds. In natural waters spawning takes place during south west monsoon.

1/ Ictiobus niger x I. cyprinellus hybrid successfully produced in ponds and reported to be 33 percent heavier than the parent species after one year.

Labeo kontius (Jerdon)

Cauvery carp. (Cyprinidae). Rivers of south India. Cultivated in ponds in south India. Food of adults consists of algal filaments, diatoms, pieces of higher plants, copepods, rotifers, insects and worms. Growth in ponds: 23–30 cm and 330 g in one year. Hardy fish, which can tolerate polluted waters. Does not breed in ponds. Female matures at 30–36 cm and male at 27 cm. Breeding in rivers takes place in June and July when the floods occur and water temperature is about 22°C.

Labeo lineatus Boulenger

(Cyprinidae). Rivers in Kasai, Africa. Experimental cultivation in ponds, in Congo and Nigeria.

Labeo rohita (Hamilton)[1/]

Rohu. (Cyprinidae). Fresh waters of India, Pakistan and Burma. Cultivated in India, Pakistan, Burma, Sri Lanka, Malaysia and Japan. Able to live in slightly brackish waters. Column feeder. Fry feed on unicellular algae and zooplankton. Up to 25 cm in length, consumes larger quantities of vegetable matter, including higher plants. Grows to 35–45 cm and 900 g in one year, 3.6 kg in two years and 5.4 kg in three years. Does not breed in ponds. Eggs, fry and fingerlings collected from rivers, reservoirs and 'bundh'-type tanks for culture in ponds along with other Indian major carps. Induced breeding by hypophysation.

Labeo senegalensis Cuvier & Valenciennes

'Adublaku'. (Cyprinidae). Fresh waters of North Africa. Cultivated in ponds in Nigeria. Breeds in ponds. In natural waters the fish is reported to migrate to swamps to spawn.

Lateolabrax japonicus (Cuvier & Valenciennes)

Japanese sea-bass; suzuki. (Serranidae). Seas of Japan, Korea, Formosa and China Sea. Moderate and experimental cultivation in China (Taiwan) and Japan respectively. Grows to about 90 cm or more. Spawns in brackish waters. Juveniles ascend rivers and stay there in spring and summer, but move to salt water in the autumn. Matures when 3–4 years old.

Lates calcarifer (Bloch)

Cock-up. (Centropomidae). Persian Gulf and Indo-Pacific seas. Cultivated in India and Pakistan (brackish waters) and Thailand and Indonesia (fresh waters). Cage culture also in Thailand. Extremely predacious column feeder. Important food items: fish, crustaceans, snails and worms. Cannibalistic when food is rare. Grows to 30 cm and 500 g in one year. Does not breed in ponds. Generally thought to breed in winter season at the mouths of estuaries.

1/ In India subsequent to the success in hypophysation it has been demonstrated that hybridization among Indian carps is a distinct possibility. Both interspecific and intergeneric carp hybrids have been successfully produced. Many of these hybrids are now under experimental cultivation.

Lates niloticus (Linnaeus)

Nile perch. (Centropomidae). Widely distributed in the Nile system and Ethiopian region of Africa. Cultivated in brackishwater ponds in Africa. Ghana, Egypt , Cameroon, Morocco, Nigeria, Uganda, etc., have the fish in freshwater impoundments also. Carnivorous. Ascends streams for short distances, for the purpose of spawning. Young fish find suitable shelter and food in littoral waters and grow rapidly. Well balanced mixed population suggested for culture in Uganda: Tilapia nilotica and T. zilli, 40 percent; Cyprinus carpio, 40 percent and L. niloticus, 20 percent.

Leiostomus xanthurus Lacépède

Spot. (Sciaenidae). Marine fish, distributed from Massachusetts to Texas (U.S.A.) and West Indies. Experimental culture in South Carolina. Grows to 25 cm and 340 g. Food: small fishes, crustaceans, worms and some plants. Makes migration to and from inshore and offshore waters. Spawning takes place in autumn or winter, not far offshore.

Lepomis cyanellus Rafinesque

Green sunfish. (Centrarchidae). Fresh waters of North America. Cultivated in ponds in U.S.A. Sport fish. Average length: 15-20 cm. Food: insects, worms, leeches, small minnows and small crustaceans.

Lepomis gibbosus (Linnaeus)

Pumpkinseed. (Centrarchidae). Fresh waters of North America. Cultivated in U.S.A. and France. Size: about 20 cm. Predaceous. Food: insects, worms, leeches, minnows and crustaceans. Spawning in late spring and early summer. Nest built by the parents on the bottom, usually in calm waters, on gravelly, sandy or weedy areas.

Lepomis humilis (Girard)

Orange spotted sunfish. (Centrarchidae). Fresh waters of North America. Unofficially stocked in ponds in Iowa. Other details same as L. gibbosus.

Lepomis macrochirus Rafinesque

Bluegill sunfish. (Centrarchidae). Fresh waters of North America, Central and South America and Africa. Cultivated in U.S.A., Congo, Zambia, Brazil and Japan. Food: fishes, insects, crayfish, etc. Eats its own eggs when food is not available. Spring spawner. Male scoops out typical saucer shaped depression in the bottom in shallow water. Hybridization occurs in nature. In one crop by stocking a large number of adults, more than 100 000 fingerlings may be produced. Within a year, by proper manipulation of the spawning ponds, two or more crops may be raised.

Lepomis microlophus (Günther)

Redear sunfish; shellcracker. (Centrarchidae). Fresh waters of North America. Cultivated in ponds in U.S.A. Feeds mainly on snails; used in Puerto Rico to destroy host of bilharzia.

Leporinus copelandi Steindachner

'Piava'. (Anostomidae). Rivers in South America. Artificial propagation by hypophysation for stocking ponds, lakes, rivers and reservoirs in Brazil. Spawns naturally in running waters only.

Leporinus elongatus (Cuvier & Valenciennes)

'Piapara'. (Anostomidae). Details same as L. copelandi.

Leporinus octofasciatus

'Piavussu'. (Anostomidae). Details same as L. copelandi.

Leporinus sp.

'Piau'. (Anostomidae). Details same as L. copelandi.

Leuciscus (Idus) idus (Linnaeus)

Ide, silver orfe. (Cyprinidae). Rivers and lakes of Europe from the Rhine eastward to Siberia. Cultivated in middle and southern states of U.S.S.R., France and Japan. Young feed mainly on zooplankton. Older fish feed primarily on benthonic insects and occasionally on fish. Grows to about 7 cm, 14 cm, 19 cm, 23 cm and 26 cm in the first five years respectively. Sexually mature at 3-5 years. Breeding season April to July; eggs are laid on stones and vegetation. Fecundity: 39 000-114 000.

Limanda yokohamae (Günther)

Flounder; makogarei. (Pleuronectidae). Japan coast and coast of Asiatic continent. Spawns in winter. Eggs adhesive and demersal. Grows to about 30 cm. Experimental culture in Japan. Artificial feeds: mackerel flesh, followed by annelids and flesh of clams.

Matsya sinensis (Bleeker)

'Tsing fish'. (Cyprinidae). Fresh waters of south west China and Yang Tze Valley. Experimental cultivation in China. Feeds on vegetable matter, crustaceans, diatoms, worms, etc. This fish has great resistance to dryness. Spawning season: May to September.

Megalobrama terminalis (Richardson)

Black bream. (Cyprinidae). Rivers in U.S.S.R., Vietnam, Laos and China. Cultivated in association with other species, in Vietnam ponds. Feeds on aquatic vegetation. Breeds in natural waters during April to May. Does not breed in ponds.

Megalops cyprinoides (Broussonet)

Tarpon; ox-eyed herring. (Megalopidae). Seas and estuaries from East Africa to Australia and Japan. Can be acclimatized to fresh waters. Cultivated in India, Sri Lanka, and Hawaii. Fry feed on small crustaceans, rotifers and diatoms. Adults consume fish, crustaceans, insects and other animals. Reported to grow to 35 cm in freshwater ponds and 40 cm in brackishwater ponds, in one year. Breeds generally in coastal waters, with prolonged season. Attains sexual maturity at about 25 cm length.

Micropterus coosae Hubbs & Bailey

Redeye bass. (Centrarchidae). Fresh waters of North America. Cultivated in ponds, in U.S.A., for sport purposes.

Micropterus dolomieui Lacépède

Smallmouth bass. (Centrarchidae). Fresh waters of North America. Cultivated in Canada, Belgium and France. Food: crayfish, fish, insects, worms, etc. Grows to about 10 cm, 15 cm, 23 cm, 27 cm, 32 cm, 35 cm and 40 cm in the first seven years respectively. Nest builder. Male builds nest on firm bottoms in shallow waters. After absorption of yolk, fry rise from the nest and swim away, convoyed by the male parent, in pursuit of food. To collect fry, a wire cylinder extending above the surface of water is placed around the nest and the male driven off. The free-swimming hatchlings are collected and transferred to rearing ponds.

Micropterus punctulatus (Rafinesque)

Spotted bass. (Centrarchidae). Fresh waters of North America. Cultivated in U.S.A. ponds. Food: crayfish, fish, insects, other crustaceans, worms, frogs and grubs. Spawning habits similar to those of smallmouth bass.

Micropterus salmoides (Lacépède)

Black bass; largemouth bass. (Centrarchidae). Fresh waters of North America from Canada to Mexico. Introduced into several countries. Cultivated in Canada, U.S.A., Egypt, Belgium, France, Spain, Congo, Cameroon, Kenya, Madagascar, Mozambique, Rhodesia, South Africa, etc. Acclimatized in Soviet lakes. Food: minnows, crayfish, worms, insects, frogs, etc. Eats also snakes, small birds, field mice, etc. Grows to about 10 cm in one year, 17 cm and 500 g in two years and 22 cm in three years. Nest site selected by male, which cleans the silt and debris with its tail. A nest may hold about 1 000 to 11 000 eggs, average being 4 000-5 000. The male guards the nest and young fry in them. As the yolk is absorbed, the young begin to feed and leave the nest. For breeding, normally 40-100 pairs are used per acre, in the ratio of four males to six females.

Misgurnus anguillicaudatus (Cantor)

Oriental weatherfish; Japanese weatherfish; amur weatherfish; mud loach. (Cobitidae). Rivers of eastern Asia. Cultivated in Japan. Grows to about 20 cm in length. Spawning takes place over muddy bottom. Induced breeding by hypophysation.

Morone mississippiensis Jordan and Eigenmann

Yellow bass. (Percichthyidae). Fresh waters of North America. Cultivated in U.S.A. ponds. Introduced in Japan. Food: minnows, worms, insects and crustaceans. Average size: 450-900 g. The fish ascends streams for spawning. Eggs are deposited on clear gravel or sandy bottom.

Morone saxatilis (Walbaum)

Striped bass; rock; rockfish. (Percichthyidae). Atlantic and Pacific coasts of North America, migrating to rivers in the region, for spawning. Cultivated in U.S.A., as a management tool and sport species. Hatchery produced fingerlings are released in natural waters. Introduced into U.S.S.R. for stocking purposes. Food: fishes and crustaceans. Males mature by third year and females by fourth year. Induced breeding by hypophysation.

Mugil auratus Risso

Golden-grey mullet. (Mugilidae). Black Sea. Cultivated in Italy and U.S.S.R. (experimental rearing in Sea of Azov basin). Unable to withstand salinities less than 20-24 ppt and in excess of 40-45 ppt. Food: periphyton, detritus and small invertebrates. Feeds intensively in estuaries during summer. Fecundity: 157 700-926 000. Attains 20-30 cm length in Soviet waters.

Mugil brasiliensis Spix

Tainha. (Mugilidae). South America. Cultivated in brackishwater ponds in Brazil.

Mugil capito Cuvier
Syn. Mugil ramada Risso

Mullet. (Mugilidae). Mediterranean and Atlantic from Scandinavia to South Africa. Found also in estuaries of West Africa. Cultivated in Greece, Italy and Israel. Able to adapt to fresh water. Grows to 40 cm length. Induced breeding by hypophysation reported to be successful in Israel.

Mugil cephalus Linnaeus

Grey mullet; jumping mullet; striped mullet. (Mugilidae). Very widely distributed in coastal waters and estuaries of tropical and sub-tropical zones of Atlantic, Pacific and Indian Oceans. Cultivated in different countries like Japan, Hong Kong, China, Philippines, Korea, India, Egypt, Israel, Italy, France, U.S.A., Hawaii, etc., as primary, secondary or experimental crop. Generally cultured in brackish waters, and occasionally in fresh waters as in India. Food: fry - phyto and zooplankton with diatoms and epiphytic Cyanophyceae; adult - algae, debris and detritus and decayed plants in ponds. Average growth: 14 cm, 24 cm, 33 cm, 39 cm and 50 cm in the first four years and 6-7 years respectively. Believed to spawn in sea during winter. Does not breed in ponds or rivers. Induced breeding by hypophysation has been successful in China (Taiwan), Israel, Hawaii, and India.

Mugil chelo Cuvier

Mullet. (Mugilidae). Atlantic, from Scandinavia to the Canary Islands and Mediterranean. Cultivated in brackishwater ponds in France and Italy (Valli fish culture). Able to adapt to fresh water. Grows to about 55 cm in length.

Mugil cunnesius Valenciennes

Mullet. (Mugilidae). Red Sea to Far East. Limited cultivation in fresh and brackishwater ponds in India. Food: algae, diatoms and detritus. Breeds in natural waters during south west monsoon. Grows to 30 cm in length.

Mugil curema Valenciennes

Tainha. (Mugilidae). South America. Cultivated in brackishwater ponds in Brazil.

Mugil falcipinnis Valenciennes

Mullet. (Mugilidae). West coast of Africa, from Senegambia to Angola. Also found in estuaries of the region. Experimental cultivation in Nigerian brackishwater ponds. Food: predominantly algae and detritus. Breeds in sea, and fry and juveniles enter estuaries. Grows up to 53 cm.

Mugil grandisquamis Valenciennes

Mullet. (Mugilidae). African coast(Senegal to Niger); estuaries of West Africa. Grows to 38 cm. Experimental cultivation in Nigerian brackishwater ponds. Food and other habits similar to M. falcipinnis.

Mugil macrolepis (Smith) Aguas

Mullet. (Mugilidae). East coast of Africa to Far East. Limited cultivation in brackishwater impoundments in India. Grows to 28 cm. Food habits similar to other mullets. Fecundity: 151 920-676 200. Induced breeding by hypophysation has been reported to be successful in Kerala (India).

Mugil parsia Hamilton
Syn. Mugil dussumieri Valenciennes

Grey mullet. (Mugilidae). Fairly wide distribution in Indo-Pacific seas and estuaries. Cultivated in brackishwater impoundments in India, Pakistan and Indonesia. Food: fry - phyto and zooplankton; adult - benthic algae, micro-fauna, decayed vegetable matter and detritus. Grows to 15-19 cm in one year. Maximum length attained in natural waters is about 40 cm and in ponds, about 25 cm. Does not breed in ponds. Believed to spawn in sea, fry occur in littoral waters in India and Indonesia during October to April. The fish can be acclimatized to fresh water.

Mugil saliens Risso

Golden-grey mullet. (Mugilidae). Black Sea; Mediterranean to South Africa. Transplanted to the Caspian Sea. Cultivated in brackishwater ponds in Greece and Italy (Valli fish culture). Adapts to fresh water. Food: periphyton, detritus and small invertebrates. Grows to 20-30 cm under culture conditions. Growth rate: 12-21 cm, 21-28 cm, 26-33 cm, 30-36 cm and 36-41 cm in the first five years respectively.

Mugil tade Forskål

Grey mullet. (Mugilidae). Red Sea, Arabian Sea and tropical Indo-Pacific seas. Cultivated in brackish waters in India, Pakistan and Indonesia. Able to adapt to even freshwater conditions. The adult is iliophagous and feeds on algae, diatoms and decayed organic matter in benthic zones. Fingerlings up to 20 mm feed on floating and attached Myxophyceae. Grows to 24-25 cm in one year, and 34-36 cm in two years. Does not breed in ponds. Presumed to spawn in Indian seas during south west monsoon and in Indonesian seas during west monsoon.

Myletes bidens Spix

Tambaqui. (Characidae). South America. Cultivated in ponds in Brazil. Herbivorous. Grows to 3 kg in two years. Sexual maturity in four years.

Mylio macrocephalus (Bleeker)

Black sea bream; black porgy. (Sparidae). Japan coast. Cultivated in Japan. Artificial propagation by hypophysation. Eggs obtained between 24-72 hours after injection. Fertilization by stripping. The hatchlings and larvae are fed with oyster larvae, rotifers, cirriped larvae, copepods and larvae of brine shrimp. Fish start feeding chopped fish or fish meal diets when they are 30-40 days old.

Mylopharyngodon piceus (Richardson)
Syn. Mylopharyngodon aethiops (Basilewsky)

Black carp; black Amur; Chinese roach. (Cyprinidae). Freshwater river-lake fish in U.S.S.R., China, Vietnam and China (Taiwan). Cultivated in China, Japan, Thailand, Vietnam, and Malaysia. Not esteemed as pond fish outside China. Pond fish fed with snails. Grows to 3-13 cm, 30-40 cm and 2.5 kg, and 65 cm and 3.5-5 kg, in the first three years respectively. Does not breed in ponds. Fry collected in rivers; after rearing in nurseries, shipped over long distances.

Mylossoma sp.

Pirapitinga. (Characidae). South America. Cultivated in ponds in Brazil. Food: fruits. Sexual maturity in three years.

Navodon modestus (Günther)

File fish, umazurahagi. (Monacanthidae). Coasts of Japan and southern Korea. Spawning season in June and July. Grows to about 32 cm. Experimental culture in Japan.

Notemigonus crysoleucas (Mitchill)

Golden shiner. (Cyprinidae). Fresh waters of North America. Cultivated in U.S.A. Commercial production in ponds as popular bait minnows. Artificial propagation in hatcheries. Food; algae, microcrustacea, insects, aquatic plants and snails. Spawns on submerged debris and vegetation. Fry can be left with adults or moved to separate rearing ponds. Heavy rate of reporudction and hence the principal problem in culture is of over population of small fish. Production rate: about 1 346 kg/ha.

Nothobranchius taenipygus Hilgandorf

Top-minnow. (Cyprinodontidae). Fresh waters of East Africa. Cultivated in Africa for biological control of mosquitoes. Ravenous feeder on insects and larvae. Eggs drought-resistant; hatch in four to six days when placed in water and grow to full size in three or four weeks in minimum of water. Temperature preference: 22-27°C. Grows to 5 cm; breeds at 4 cm.

Odonthestes (Basilichthys) bonariensis (Cuvier & Valenciennes)

Atherinid pejerry; silver side. (Atherinidae). Lake system of Buenos Aires. Artificial propagation Santa Fe, La Pompa, Cordoba and San Luis. Introduced for cultivation in Japan, Italy and Morocco.

Oncorhynchus gorbuscha (Walbaum)

Pink salmon; humpbacked salmon. (Salmonidae). Northern part of Pacific Ocean - American shores. Marine and freshwater migratory fish. Hatchery propagation in Canada. Food: young - insects and worms; adults - insects, worms, crustaceans and small fish. Grows to 44-49 cm. Males larger than females. Grows rapidly and becomes sexually mature in second year. Fecundity: low, average being 1 519.

Oncorhynchus keta (Walbaum)

Chum salmon; dog salmon. (Salmonidae). Asiatic shore of U.S.S.R., to Korea, northern Japan and American coast, south to San Francisco. Cultivated in Japan (saltwater and freshwater ponds) and U.S.S.R. (in hatcheries during low winter temperatures). Food: insects, worms, crustaceans, small fish and detritus.

Oncorhynchus kisutch (Walbaum)

Coho salmon; silver salmon. (Salmonidae). North American coast of the Pacific Ocean and Asiatic coast from Anadyr to Hokkaido (Japan). Cultivated in North America; successfully introduced into the Great Lakes. Very popular with sportsmen. Average weight: 4-5 kg. Food: insects, worms, crustaceans and small fish. Sexually mature in third or fourth year. Fecundity: about 5 000. Spawning and hatching period extremely prolonged. Young usually stay in rivers for two years where they feed first on zooplankton and later on fish.

Oncorhynchus nerka (Walbaum)

Sockeye salmon; red salmon; blueback salmon. Land-locked forms known as kokanee. (Salmonidae). Asiatic shores from Anadyr to Hokkaido, Kamchatka River in U.S.S.R., Bering Strait to California in U.S.A., lakes of Japan, Kamchatka and North America. Cultivated in Japan and Canada. Artificial propagation in U.S.S.R. Migration to the rivers of Kamchatka usually begins from end of May and peaks from middle of June to end of July. Red salmon in migratory state is four to six years old. Spawn chiefly in lakes. Food in rivers - planktonic crustaceans; in sea - fish. Reported to consume insects and worms also. Average weight: 2.5-4 kg. Fry reared in nurseries for stocking operations. Generally not suited for ponds.

Oncorhynchus rhodurus (Jordan & McGregor)

Salmon; 'Amenouo'. (Salmonidae). Rivers of south Japan. Artificial propagation by stripping and artificial fertilization in Japan. Predatory fish. Spawns in November in streams. Maximum size about 50 cm. Not suitable for cultivation in ponds. Seldom attains length of more than 25 cm.

Oncorhynchus tshawytscha (Walbaum)

King salmon; chinook salmon; quinnat salmon. (Salmonidae). South California to Alaska; northern Japan on Asiatic side. Introduced in Chile and New Zealand. Hatcheries, experimental culture in U.S.A. One of the largest game fish found on the Pacific coast of U.S.A. Food: small salmon, before migrating to sea feed on insects, worms and crustaceans. At sea, small fish, shrimps, squids and other crustaceans are consumed. Breeds in its third year of life. Major portion of life spent at sea and the fish ascends freshwater streams, to spawn. Fecundity: 4 600-14 300. Spawning takes place in autumn and the eggs hatch in about 50 days. Some of the young make their way to sea at once, but others remain in fresh water until the following year.

Ophiocephalus marulius Hamilton
Syn. Channa marulius (Hamilton)

Snakehead; murrel. (Ophicephalidae). Fresh waters of India, Sri Lanka, Burma, Thailand, Vietnam and China?. Cultivated in fresh waters of India, Pakistan, Malaysia, Khmer, etc. Food: small fishes, frogs, tadpoles and water insects. Fast grower, attaining about 12 cm in two months and 40 cm in one year. Breeds in ponds without particular measures. Breeding season in India: April-June. Nest builder and parental care till young ones are able to take food.

Ophiocephalus obscurus Günther

(Ophicephalidae). Fresh waters of Senegal to Congo (Africa). Cultivated for Tilapia control in Cameroon and Nigeria.

Ophiocephalus punctatus (Bloch)
Syn. Channa punctatus (Bloch)

Snakehead; murrel. (Ophicephalidae). Fresh waters of India, Pakistan, Burma, Sri Lanka, Malaysia, China, Tahiti and Polynesia. Cultivated in India and Pakistan. Fry up to 5 mm feed mainly on unicellular algae, beyond this stage they show carnivorous tendencies. Up to 8 cm length, the food items are protozoans, rotifers, copepods, insects and vegetable matter. Larger fish consume mostly fishes. Matures in first year. Nest building and parental care similar to other species of the genus.

Ophiocephalus striatus Bloch
Syn. Channa striatus (Bloch)

Snakehead; murrel. (Ophicephalidae). Fresh waters of India–Sri Lanka to China and through Indonesia and Borneo to the Philippines. Cultivated in India, Indonesia, Malaysia, Khmer and Pakistan. Able to tolerate slightly brackish water. Food: fish, frogs, insects and snails. Breeds in ponds without particular measures. Matures when about two years old. Spawning season in India May–June and December–February, in Indonesia January–May and Sri Lanka before and after rainy season. Nest prepared by parent fish biting off the aquatic vegetation over a roundish area in shallow water near the edge of a lake or canal. When eggs are laid, they form a thin film, which is guarded by the male. Able to live in foul water because of accessory respiratory organ. Can survive for months without water when buried in moist soil.

Oryzias melastigmus (McClelland)

Paddle fish. (Cyprinodontidae). Fresh waters of India, Pakistan, Burma and Sri Lanka. Cultivated in India for mosquito control. Attains about 38 mm length.

Oplegnathus punctatus (Temminck & Schlegel)

Spotted parrot fish; ishigakidae. (Oplegnathidae). Occurs in waters southward from middle Honshu, Korea and East China Sea. Grows to about 40 cm. Experimental culture in Japan.

Osphronemus goramy (Lacépède)

Gourami. (Osphronemidae). Fresh waters of Indonesia, Thailand, Malaysia, Khmer and Vietnam. Transplanted to many countries. Cultivated in Indonesia, India, Malaysia, Singapore, Thailand, Philippines, Sri Lanka, Vietnam, Madagascar, etc. Hatcheries have been established in Thailand. Able to live in slightly brackish waters. Nest builder. Fecundity: 500–2 000. Useful in controlling some aquatic weeds.

Osteochilus hasseltii (Cuvier & Valenciennes)

Nilem. (Cyprinidae). Lakes and rivers of Indonesia, Malaysia, Thailand, Vietnam and Khmer. Cultivated in ponds in Indonesia, Malaysia and Thailand. Hatcheries have been established in Thailand. Larvae and fry feed on phyto and zooplankton, unicellular algae being the main items. Adults feed on Bacillariophyceae, Desmidiaceae, Chlorophyceae and soft or decayed leaves of higher plants. Nibbles at the leaves of aquatic plants and rasps off the covering growth of vegetable micro-organisms. Breeds in ponds if suitable measures are taken. In the special spawning ponds a strong flow of water across a bed of coarse gravel or stones is produced. Maximum length: 35 cm.

Osteochilus thomassi (Day)

Nagendram fish. (Cyprinidae). Rivers of south India. Cultivated in ponds in south India. Food: phytoplankton, mainly diatoms and filamentous algae. The fish browses on bottom and at margins of ponds. Grows to 30 cm and 300–400 g in one year, in ponds. Does not breed in ponds. Matures at about 23 cm, about one year old. Spawning season: May–June.

Oxyeleotris marmorata (Bleeker)

Sandgoby, pla bu. (Eleotridae). Rivers and estuaries of Thailand, Malaysia, Philippines, Fiji Islands, etc. Cultivated in Malaysia and Vietnam. Grows to 46 cm.

Pagrus major (Temminck & Schlegel)

Red sea bream. (Sparidae). Japan coast. Experimental cultivation in Japan. Artificial propagation by stripping, for release in natural waters. About 100 000–500 000 fry are provided annually by the hatcheries. At water temperature of 14°C, growth is reported to be 0.6–0.7 kg in 1½ years and 1.2–1.5 kg in 2½ years. Spawning season: May to early June. Fry are fed with rotifers, zooplankton and nauplii of brine shrimp. At 15–20 mm length, when the fry are about one month old, chopped flesh of fish and shrimps is given.

Pangasius larnaudi Bocourt

Catfish. (Pangasidae). Rivers and lakes of Thailand and adjoining parts of Indo-China (Khmer and Vietnam). Cultivated in Thailand and Vietnam. Feeds in confined waters on almost any food offered. Grows to about 450 g in one year and 1 kg in two years. Maximum weight of fish in ponds or cages is about 1.5 kg. Does not breed in ponds. Fry collected from rivers during August–September.

Pangasius micronemus Bleeker

Catfish. (Pangasidae). Rivers of Indonesia, Malaysia, Thailand, Khmer, Vietnam and North Borneo. Cultivated in freshwater ponds in Vietnam. Carnivorous in open waters and omnivorous in ponds. Quick grower. Cage culture in Thailand. Does not spawn in ponds.

Pangasius pangasius (Hamilton)

Catfish; pangas. (Pangasidae). Rivers of India, Burma, Java and Thailand. Cultivated in Thailand. Experimental cultivation in India, mainly for mollusc control. Carnivorous. Does not breed in ponds.

Pangasius sanitwongsei H.M. Smith

Catfish. (Pangasidae). Fresh waters of Thailand. Occasionally reared in pens and ponds in Thailand and Vietnam. Voracious predator: feeds on carcasses. Does not breed in confined waters. Grows up to 3 m in length. Generally inhabits deeper parts of the rivers and only the young are likely to be observed in the minor tributaries.

Pangasius sutchi Fowler

Catfish. (Pangasidae). Rivers and lakes of Indonesia, Malaysia, Thailand, Khmer and Vietnam. Cultivated in Thailand and Vietnam. Cage culture in Thailand. Carnivorous in open waters and omnivorous in ponds. Grows to 150 cm length. Does not spawn in ponds. Spawning period in rivers: March–May. Fry collected generally from August to September.

Parabramis pekinensis (Basilewsky)

White Amur bream. (Cyprinidae). Rivers of Amur basin (U.S.S.R.) and China. Cultivated in China. Fry feed on zooplankton; adults take in vegetation along with little quantities of animal matter. Grows to 8 cm, 11 cm, 15 cm, 19 cm, 22 cm, 27 cm, and 29 cm in the first seven years respectively. Matures in sixth year. Spawning season: generally summer.

Paralichthys lethostigma Jordan & Gilbert

Southern flounder. (Paralichthyidae). Seas from South Carolina northward and Gulf coast and up to New York. Experimental saltwater cultivation in South Carolina, U.S.A. Spawning season: November–December.

Paralichthys olivaceus (Temminck & Schlegel)

Pacific flounder; hirame (Paralichthyidae). Japan coast and up to Hong Kong. Most delicious and expensive flounder in Japan. Grows up to about 80 cm. Experimental culture in Japan.

Parasilurus asotus (Linnaeus)

Korea catfish; Amur catfish. (Siluridae). Lake-river fish in plateau of Amur basin (U.S.S.R.), China, Korea and central Japan. Experimental rearing in small ponds in Korea. Food: smaller fish. Ceases feeding during winter. Generally spawns in still backwaters, having submerged vegetation, at temperatures 16-18°C. Does not build any nest, scatters eggs at random and does not protect them.

Paratilapia polleni Bleeker

(Cichlidae). Fresh waters of Madagascar. Experimental cultivation in Madagascar. Grows to about 20 cm length.

Perca flavescens (Mitchill)

Yellow perch. (Percidae). Lake-river fish in eastern part of North America. Introduced to Pacific coast of U.S.A. Cultivated in U.S.A. and Japan. Average size: about 450 g. Food: worms, small minnows, crayfish and insects. Voracious feeder. Spawning in spring. No nest is prepared, but the eggs are produced in a zig-zag gelatinous string which the male fertilizes as they appear. The young hatch in one week.

Perca fluviatilis Linnaeus

English perch; common perch. (Percidae). Europe, North America and northern Asia. Found in freshwater brooks, rivers and lakes, both warm and cold from sea level up to 1 100 m; also in brackish waters. Cultivated in Australia and Morocco. Post larvae feed on zooplankton and adults on insects and crustaceans. Spawns usually in April and May. Eggs are laid in long strings on plants, stones and other supports along with shallow margins of lakes and rivers. Fecundity: 12 000-300 000. Highly esteemed as food fish because of its excellent flavour.

Petenia esplendida Günther

Tenguayaca. (Cichlidae). South America. Cultivated in ponds in Brazil.

Phoxinus phoxinus (Linnaeus)

European minnow. (Cyprinidae). Whole of Europe with the exception of southern Spain and Iceland. Cultured as baitfish for salmonids. Food: mainly insect larvae and small crustaceans. Breeding season during April to July. Matures at three to four years. Breeding in captivity not difficult.

Pimelodus clarias Bloch

Mandi. (Pimelodidae). South America. Experimental culture in Brazil. Grows to 30 cm.

Pimephales notatus Rafinesque

Bluntnose minnow. (Cyprinidae). Fresh waters of North America. Cultivated in U.S.A. as baitfish. Spawns over a long period as soon as water reaches 21°C. Eggs adhesive and laid in water from 15-90 cm deep. Females can spawn twice in one season.

Pimephales promelas Rafinesque

Fathead minnow. (Cyprinidae). Fresh waters of North America. Cultivated in U.S.A. ponds. Postspawning mortality of adults reported to be 20-91 percent, with higher survival of females. Generally sex ratio is 5 females:1 male.

Plagioscion squamosissimus Heckel

Pescado do piau; corvina. (Sciaenidae). South America. Experimental culture in freshwater ponds in Brazil. Carnivorous. Grows to 16 kg. Very sensitive to changes in temperature and dissolved oxygen. Spawns naturally in ponds.

Plagioscion surinamensis (Bleeker)

'Pescada cacunda'. (Sciaenidae). Fresh waters of South America. Extensively used for cultivation in Brazil. Naturally spawns in lakes. Artificial propagation by hypophysation.

Plecoglossus altivelis Temminck & Schlegel

Ayu. (Plecoglossidae). From sea to fresh waters in southern Japan, Korea and northern part of China (Taiwan). Cultivated in Japan (cage culture under experimentation). Experimental cultivation in U.S.S.R. Food: diatoms, blue-green algae and other algal vegetation attached to pebbles and stones in river beds. Migrating form ('Ayu')ascends rivers during March to May and descends to lower reaches to spawn during October and November. Fry migrate to sea. Landlocked form ('Koayu') inhabits inland waters; spawns in the same habitats. Eggs of landlocked form obtained by stripping are artificially fertilized and shipped over long distances. Eggs obtained by light treatment also, but the quality of eggs produced thus are reported to be poorer than those from river bred fish.

Pleuronectes platesa Linnaeus

Plaice. (Pleuronectidae). Seas of Scotland and England; transplanted to Denmark. Experimental cultivation in Isle of Man. In a 5-acre pilot project in Scotland, which is Britain's first sea fishfarm, the hatchery survival is reported to be 66 percent.

Pneumatophorus japonicus diego (Ayres)

Pacific mackerel. (Scombridae). West coast of North America (Alaska to California); east coast of Asia (?). Experimental mariculture in U.S.A. Food: fish, squids, shrimps, copepods, etc. Supposed to be a scavenger. Known to spawn in open bays.

Pogonias cromis Linnaeus

Black drum. (Sciaenidae). Bays, inlets and seas from Long Island to Florida and Texas (U.S.A.); said to run to Argentina. Able to tolerate brackish waters up to salinity of 20 ppt. Cultivated along with mullet and Sciaenops sp. in South Carolina in U.S.A. Predatory fish, the common food items being fishes, crustaceans and molluscs. Bottom feeder.

Polyodon spathula Walbaum

Paddle fish. (Polyodontidae). Rivers and lakes of U.S.A. Cultivated in ponds in U.S.A. Artificial propagation in hatcheries. Food: pelagic crustaceans and insect larvae. The fish feeds by swimming in deep layers of the water with its mouth open, thus filtering planktonic animals in the dense gill rakers. Spawns in the spring, on sandy or stony bottoms in channels and in shallow lakes.

Polypterus senegalus Cuvier

(Polypteridae). Rivers and lakes of Africa. Experimental culture in Cameroon (abandoned in many cases). Carnivorous fish. Spawns from July to September in natural waters.

Pomoxis annularis Rafinesque

White crappie. (Centrarchidae). Fresh waters of North America. Cultivated in ponds in U.S.A. and Morocco. Food: insects, crustaceans and fish. Nests built around the roots of vegetation. Young sluggish and rarely seen. Production reported to be 15 000–20 000 fingerlings per 0.5 ha.

Pomoxis nigromaculatus (Lesueur)

Black crappie. (Centrarchidae). Fresh waters of U.S.A. Cultivated in ponds in U.S.A. and Morocco. Food: fishes and crustaceans. Grows to 8 cm, 15 cm, 20 cm, 25 cm, and 30 cm in the first four years and seventh year respectively. Male builds and guards the nest. Spawns in late spring and early summer.

Prochilodus argenteus Spix

'Curimbata pacu'. (Anostomidae). Rivers and streams in northern South America. Spawns in running waters. Propagation by hypophysation in Brazil for stocking ponds, lakes, rivers and reservoirs.

Prochilodus scrofa Steindachner

'Curimbata'. (Anostomidae). Rivers and streams in northern South America. Details same as P. argenteus.

Prochilodus sp.

'Curimbata comum'. (Anostomidae). Rivers and streams in northern South America. Details same as P. argenteus.

Puntius belinka (Bleeker)

'Belinka'. (Cyprinidae). Freshwater river fish in Sumatra and Malaysia. Cultivated in ponds in central Sumatra and Indonesia. Plankton and detritus feeder, the important food items being planktonic animals and soft aquatic plants. Could possibly be bred in ponds. Fry generally collected from rivers. Grows to about 675 g in one year. Maximum length: 24 cm.

Puntius carnaticus (Jerdon)

Carnatic carp. (Cyprinidae). Rivers of south India. Cultivated in ponds in south India. Fry feed on phyto and zooplankton and aquatic insects. Adult consumes higher plants, filamentous algae, crustaceans, insects and small fish. Grows to 25–30 cm and 1.3 kg in one year. Does not breed in ponds. Spawning season in rivers: monsoon months.

Puntius gonionotus (Bleeker)
Syn. Puntius javanicus (Bleeker)

Tawes. (Cyprinidae). Rivers of Indonesia, Thailand, Vietnam and transplanted to Sri Lanka. Cultivated in Thailand, Indonesia, Malaysia and Singapore. Able to survive in brackish waters up to salinity of 7 ppt. Food: aquatic vegetation. Column and surface

feeder. Grows to 250-500 g in one year, in ponds. Production rate in ponds: up to 500 kg per ha. Spawns in rivers at the beginning of rainy season. Breeds in ponds when suddenly transferred into fresh water. In Indonesia special methods are adopted for spawning in ponds. Induced breeding by hypophysation has been successful.

Puntius orphoides (Cuvier & Valenciennes)

'Mata mera' (red eye). (Cyprinidae). Rivers and lakes in Indonesia, Malaysia, Thailand and Khmer. Cultivated in ponds in Indonesia. Grows to about 25 cm. Spawns when about 8 cm long and 8 months old. Breeds in ponds throughout the year if specific measures like provision of good supply of well-oxygenated water, suitable plants for attachment of eggs, etc. are taken. Fry feed on unicellular algae; young fish and adults on phyto and zooplankton, epiphytic vegetation and decayed parts of higher plants. Eagerly consumes artificial food.

Puntius sarana (Hamilton)

(Cyprinidae). Rivers of India, Burma and Thailand. Limited cultivation in ponds in India, Pakistan and Burma. Grows to about 30 cm.

Puntius schwanefeldii (Bleeker)

'Lampai'. (Cyprinidae). Rivers of Indonesia, Malaysia, Thailand, Khmer and Vietnam. Cultivated in ponds in Indonesia, Malaysia, Vietnam and Japan. Food: planktonic and epiphytic organisms and fresh and decayed aquatic plants. Grows to about 35 cm. Matures at 15-20 cm length. Breeds and spawns occasionally without any special measures.

Pylodictis olivaris (Rafinesque)

Flathead catfish. (Ictaluridae). Rivers of North America. Cultivated in freshwater ponds in U.S.A. Fry and fingerlings cultured in troughs. Food: practically anything that can be ingested. Average weight: about 20 kg. The fish prefers slow moving, sluggish and mud-bottomed rivers.

Rhamdia guatemalensis (Günther)

Juilin. (Pimelodidae). Fresh waters in northern South America. Cultivated in ponds in Guatemala. Production rate reported to be 24-159 kg/ha.

Rhinichthys atratulus Hermann

Blacknose dace. (Cyprinidae). Lives in cold and clean water courses in north U.S.A. Cultured in U.S.A. as bait fish. Spawning in running waters during April and May. Artificially propagated eggs measure 3 mm in diameter after swelling.

Rhinomugil corsula (Hamilton)

Grey mullet. (Mugilidae). Found in estuaries and fresh waters far above tidal influence in India, Pakistan and Burma. Cultivated in fresh and brackishwater impoundments in India. Fry feed on copepods and insects, while adults consume filamentous algae floating on water surface, along with the insects and molluscs adhering to them. In confined waters browsing habit is also reported. Not known as to whether the fish breeds in ponds. In nature, the breeding season (in fresh waters) is from May to September. Grows to 35-45 cm in three years.

Rutilus frisii kutum (Kamensky)

'Kutum'. (Cyprinidae). Inhabits the Caspian Sea, mainly its southern region. Hatchery propagation and experimental culture in Azerbaidzhan (U.S.S.R.). Spawning migration into rivers takes place during February to April. Matures at four years.

Rutilus leuciscus rutilus (Linnaeus)

Dace. (Cyprinidae). River-lake fish cultivated in Belgium, France, Madagascar and Morocco. Stocked in rice fields in the latter two countries. Introduced in Poland for stocking natural waters.

Salmo aguabonita Jordan

Golden trout (of the west U.S.A.). (Salmonidae). Native to high mountain streams of California; has been transplanted to other western states in U.S.A. Cultivated in North America. Food: insects, larvae of insects, worms and spawn of other fishes. Grows to average weight of about 450 g. Generally inhabits clear water only and is a spring spawner.

Salmo clarki Richardson

Cutthroat trout. (Salmonidae). Inhabits waters from sea level to mountain lakes of altitude 3 000 m, in west America. Cultivated in North America. Food: insects, crustaceans, worms, small fish and salmon and trout eggs. Grows to average of 200-450 g in smaller streams and 1-3 kg in larger waters. Those with access to the ocean inclined to migrate to such seas. Spawning in spring or mid-summer. Fecundity: 3 000-6 000 or more.

Salmo gairdneri Richardson

Rainbow trout; steelhead. (Salmonidae). Native in rivers on the west coast of North America. Introduced into several countries. Cultivated in North America, Africa, Australia, Norway, Denmark, Tasmania, India, Sri Lanka, Japan, U.S.S.R., etc. Experimental culture (transplantation into sea) in Baltic Sea. Temperature tolerance in ponds: 14°C or less. Fry feed on zooplankton while juveniles and adults consume insects, worms, snails, crustaceans and small fish. Grows to 8 cm, 20 cm, 38 cm, 40 cm and 45 cm or more in the first five years respectively. Maximum length over 70 cm. Spawning takes place generally between early winter and beginning of summer, and is accompanied by at least some upstream migration. Nest dug by female and eggs covered with loose gravel. Artificial hatching in special hatcheries. Eyed eggs can be transported four or five days after the eyes appear, in wooden trays or other suitable containers. Fresh water/salt water culture reported to be more advantageous than purely in fresh water. Considered to be valuable addition in carp ponds in European countries.

Salmo letnica Karamen

(Salmonidae). Cultivated in high altitude waters in Morocco, for sport fishing.

Salmo salar Linnaeus

Atlantic salmon. (Salmonidae). Northern part of Atlantic Ocean. The so-called landlocked salmon is found in inland waters of New England states and New York, lakes of Karelia, Sweden, etc. Cultivation and artificial propagation in several countries like Canada, U.S.A., Norway, U.S.S.R., etc. Food of sea-run form: in river fry feed on insect larvae and older forms on benthonic fish; in sea, feeds mainly on fish. Different groups of migratory fish having varied characteristics have been distinguished. The sea-run form attains maturity in sea and migrates to spawning rivers; young fish remain in river for 1-5 years. Before entering sea, the fish undergoes many changes. The landlocked form ascends rivers flowing into lakes, for spawning, during October-November. Nest-like holes built by both the forms. Fecundity: average of 8 000-10 000.

Salmo trutta Linnaeus

Brown trout; salmon trout. (Salmonidae). Brook, river and lake fish, in European countries. Introduced into North America. India, New Zealand, Africa, etc. Cultivated in ponds in U.S.S.R., North America, Australia, Africa, New Zealand, etc. Artificial propagation for stocking streams at heights of more than 1 000 m above sea level, with maximum temperature of 20-22°C, in Indo-Pacific countries like India, Sri Lanka, Japan, Australia, etc. Food: small animals of all kinds. Larger specimens consume fishes and vegetable matter also. Spawns during October to January (in some cases in February and September also). Eggs deposited in crevices between stones and gravel. Artificial propagation in hatcheries by stripping. Grows to maximum length of over 1 m.

Salmo trutta trutta Linnaeus

Common trout. (Salmonidae). River-sea fish in Europe and northern Asia. Artificial propagation in U.S.S.R. and some European countries. The fish remains in fresh waters for three to seven winters, and feed chiefly on insects and insect larvae. In sea, feeds mainly on fish and crustaceans. The migration in river is usually very extended. Spawning occurs during October to December.

Salvelinus fontinalis (Mitchill)[1/]

Brook trout. (Salmonidae). North American species, cultivated in U.S.A. and Canada. Food: smaller fishes, insects, worms, molluscs, crustaceans and even frogs. Grows to 8 cm, 15 cm, 22 cm, 30 cm, and 33 cm in the first five years respectively. Spawning takes place in the autumn, in shallows of headwater streams. Redd constructed by female and fertilized eggs covered with loose gravel. Eggs hatch in seven to eight weeks, depending on water temperature.

Salvelinus malma (Walbaum)

Mountain trout; Dolly Varden trout. (Salmonidae). Pacific coast of Asia; southern parts of Japan restricted to cold headwaters of rivers; Pacific slope of North America from Sacramento to Alaska. Landlocked freshwater river and stream fish cultivated in Japan and Alaska. Predatory fish. Autumn and winter spawner. Landlocked form spawns in streams and propagates freely. Ocean-run spawners migrate upstream and when spent, return to sea or if they are stream residents, drop back downstream. Grows to a length of 70 cm.

Salvelinus namaycush (Walbaum)

Lake trout. (Salmonidae). Fresh waters of northern portion of North America. Cultivated in Canada. Spawns on lake bottoms, with mounds of pebbles, stones or small boulders for the deposit of eggs. Eggs not covered. Sharp rocks make better spawning grounds.

Salvelinus sp.

(Salmonidae). Cultivated in Morocco for sport fishing.

Scardinius erythrophthalmus (Linnaeus)

Rudd. (Cyprinidae). Fresh waters of western Europe and the basins of the Baltic, Black, Caspian and Aral Seas (U.S.S.R.). Cultivated in Belgium and France. Inhabits clear sluggish or stagnant waters overgrown with vegetation. Larvae feed on zooplankton. Juveniles

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1/ Hybrid of S. fontinalis and S. namaycush (Walbaum) reported to be successful for cultivation.

feed mainly on vegetation. Grows to 7 cm, 9 cm, 13 cm, 17 cm and 21 cm in the first five years respectively. Sexually mature at three years. Spawns during April to July. Fecundity: 96 000–232 000.

Sciaenops oscellata (Linnaeus)

Red drum. (Sciaenidae). Seas and estuaries of North America. Cultivated in ponds in South Carolina, U.S.A. Able to live in brackish waters up to salinity of 20 ppt. Most adaptable to pond habitat in the region. Predatory fish.

Semotilus atromaculatus (Mitchill)

Creek chub. (Cyprinidae). Found in relatively calm waters in U.S.A., from the Rocky Mountains to the Atlantic. Cultivated in U.S.A. since considered excellent for catching pike. Spawning between April and June in the gravel beds of running waters. Artificial fertilization by hypophysation.

Seriola purpurascens Temminck & Schlegel

Rudder fish. (Carangidae). Widely distributed on each side of Japan, to China (Taiwan) and east coast of Korea. Small-scale cultivation in Japan. Grows to 1 m or more.

Seriola quiniqueradiata Temminck & Schlegel

Yellow tail (North Pacific). (Carangidae). North Pacific seas; Japan coast. Cultivated in Japan, in Seto Island sea areas.

Serranochromis angusticeps (Boulenger)
Syn. Paratilapia angusticeps Boulenger

(Cichlidae). Fresh waters of Angola, Bechuanaland and Zambesi, and Lake Bangwela, in Africa. Cultivated in ponds in Central East Africa. Grows to 25 cm. Feeds mainly on insects. Nest constructed by male. Breeding from August to January. Mouth breeder; hatching inside the mouth of the female. 20–30 cm fish may produce 200–1 000 eggs at a time. Matures at about 20 cm length in reservoirs, but in ponds fish of smaller size may be mature.

Serranochromis macrocephala (Boulenger)
Syn. Paratilapia macrocephala Boulenger

(Cichlidae). Lake Mweru, Luapula river, etc. in Africa. Cultivated in ponds in Central East Africa. Grows to 33 cm. Other details same as for S. angusticeps.

Serranochromis robustus (Günther)
Syn. Pelmatochromis robustus Günther

(Cichlidae). Occurs in lower reaches of rivers and off rocks in open waters of Lake Nyasa (Africa). Cultivated in ponds in Central East Africa. In Zaire the fish is cultivated for Tilapia control. The species is faster growing than the other three species of the same genus. Other details same as for S. angusticeps.

Serranochromis thumbergi (Castelnau)
Syn. Paratilapia thumbergi Castelnau

(Cichlidae). Fresh waters of Central and East Africa. Cultivated in ponds in the same region. In Zaire cultured for Tilapia control. Other details same as for S. angusticeps.

Siluris glanis Linnaeus

Sheatfish; common catfish. (Siluridae). Rivers, lakes and brackish waters in basin of the Black, Caspian and Aral Seas, and east of the Rhine river in U.S.S.R. Also occurs in the eastern part of the Mediterranean. Cultivated in Hungary, Yugoslavia and Czechoslovakia. Able to tolerate salinity up to 14 ppt. Small fish, frogs and tadpoles form the main food of the species. 10–20 days old young ones develop cannibalistic habits. Grows to 5–6 cm in nursery ponds during 30–35 days. Nest builder. Spawning takes place late in the evening and at night. Artificial hatching crates have been successful. 5 000–7 000 fingerlings of the same size can be stocked for every 100 m^2 water area.

Siniperca chuatsi (Basilewsky)

Mandarin fish; Chinese perch. (Epinephelidae). Fresh waters of China and Amur region. Cultivated as extraneous fish in China. Adults feed on fish and crustaceans.

Solea solea (Linnaeus)

Common sole. (Soleidae). Occurs in seas along the coast of Europe from the Black Sea to the Mediterranean. Experimental mariculture in United Kingdom. Feeds on crustaceans, molluscs and small fish. Reaches 61 cm in length. Usually lives at depths of 20–60 m. Spawning in February to August. Fecundity: about 150 000. Incubation period at water temperature of 9–10°C is about 10 days.

Sparus auratus Linnaeus
Syn. Chrysophrys aurata Cuvier & Valenciennes

Gilt-head bream. (Sparidae). Mediterranean, Black Sea, southern coast of England. Cultivated in northern Adriatic Sea. Does not breed in ponds. Either young ones are trapped in ponds or fry stocked. Experimental induced breeding in France and Italy.

Squaliobarbus curriculus (Richardson)

Barbel chub. (Cyprinidae). Fresh waters of China, Vietnam, Laos and U.S.S.R. Also reported from rivers in western Korea. Cultivated in ponds in association with other cyprinoid fishes in Vietnam. Hardy fish, able to stand transportation over long distances. Column feeder, consuming zooplankton during fry stage and vegetable and animal food items during later stages. Does not breed in ponds.

Stephanolepis cirrhifer Temminck & Schlegel

File fish; porky; Kawahagi. (Monacanthidae). Occurs from Japan coast to East China Sea and southern Korea. Spawning season probably extends from the end of June to August. Grows to about 25 cm. Experimental culture in Japan.

Stizostedion (Lucioperca) lucioperca (Linnaeus)

Pike-perch. (Percidae). Rivers and basins of the Baltic, Black, Caspian and Aral Seas. Cultivated in European countries like Yugoslavia, Hungary, East Germany, etc., Morocco and U.S.S.R. Lives in rivers, clear lakes and also in saline waters. Fry feed on zooplankton and adults on fish. Grows to 12–25 cm and 30–100 g in one year, 30–40 cm and 200–500 g in two years and 37–55 cm and 500–1 500 g in three years. Breeds in ponds when nest-making materials are provided. One nest and one spawning pair may be stocked for every 2–5 m^2 basin surface. About 1 000–2 000 eggs can be stocked per ha. Induced breeding by hypophysation.

Stizostedion vitreum vitreum (Mitchill)

Yellow pike perch; walleye; yellow walleye. (Percidae). Freshwater lakes in North America. Cultivated in ponds in U.S.A. and Canada. Artificial propagation by stripping. Food: small fishes, worms, crayfish, crustaceans, insects and frogs. Grows to 10 cm, 21 cm, 30 cm, 37 cm and 45 cm in the first five years respectively. Spring spawner in lakes and rivers. In rivers upstream migration and in lakes shoreward migration take place for breeding. Extremely prolific breeder, an average fish laying 50 000 to 60 000 eggs.

Tetradon fahaca Linnaeus

(Tetraodontidae). Nile, Chad Basin, Senegambia and Niger (Africa). Experimental cultivation in Cameroon for Tilapia control, but the results are reported to be poor.

Thymallus arcticus (Pallas)

Arctic grayling. (Thymallidae). Fresh waters of Siberia (U.S.S.R.) and North America (mostly abundant in Alaska). Cultivated in some waters of Yellowstone country (U.S.A.). Food: aquatic insects, invertebrates and some small fishes. Spawns in early spring. Sexually mature at 4–5 years. Fecundity: 5 000–10 000.

Thymallus thymallus (Linnaeus)

Grayling. (Thymallidae). Fresh waters of Europe, Asia and North America. Cultured in Yugoslavia. Primarily a river fish and spawns in spring from March to May when water temperature is about 10°C. Sexual maturity at two years for males and three years for females. Artificial feeds given include liver, spleen and cultured plankton.

Thynnichthys sandkhol (Sykes)

Sandkhol carp. (Cyprinidae). Fresh waters of south India, Burma and Malaysia. Cultivated in ponds in south India. Food: 80 percent of Myxophyceae, Chlorophyceae and Bacillariophyceae and 20 percent Protozoa, Rotifera and Crustacea. Fast growing fish, attaining 45–60 cm and 0.9–1.4 kg in one year. Does not breed in ponds. Mature when about 30 cm long, in the first year of life. Spawns during June to September.

Tilapia andersonii Castelnau[1/]

Tilapia. (Cichlidae). Fresh waters of Kafue, Upper Zambesi, Okavango, Angola, Congo, Gabon, etc. in Africa. Cultivated in ponds in Congo, Rhodesia, Zambia, etc. Bottom feeder, consuming mainly algae. Grows to about 200–225 g in one year in ponds. Fecundity: 300–700. Generally stocked in combination with other species of the genus.

Tilapia aurea (Steindachner)[2/]

Tilapia. (Cichlidae). Fresh waters of Uganda (Africa). Cultivated in freshwater ponds in Uganda. Experimental cultivation in brackishwater ponds in Israel. Introduced in U.S.A.

1/ Hybrids of T. andersonii x T. macrochir and T. andersonii x T. mossambica are under experimental cultivation in Rhodesia.

2/ Hybrid of T. aurea x T. nilotica (L.) under experimental cultivation in Uganda

Tilapia christyi Boulenger

Tilapia. (Cichlidae). Fresh waters of Congo. Cultivated in freshwater ponds in Zambia. Grows to 18 cm length.

Tilapia esculenta Graham

Tilapia. (Cichlidae). Lake Nyasa. Cultivated in freshwater ponds in Tanzania (Africa).

Tilapia flavomarginata Boulenger

Tilapia. (Cichlidae). Fresh waters of Lake Ngami district, Angola, Congo, Gabon, etc. in Africa. Cultivated in freshwater ponds in Gabon.

Tilapia galilaea (Artedi)

Tilapia. (Cichlidae). Fresh waters of Galilee and Jordan to Nigeria (Nile and Senegal) in Africa. Cultivated in freshwater ponds in Cameroon, Central African Republic, Congo, Ghana, Ivory Coast, Morocco, Togo and Israel. Phytoplankton feeder. Maximum size: 35 cm and 800 g. Average table fish size: 20 cm and 150 g. Buccal incubation by female.

Tilapia heudelotii Dumeril
Syn. Tilapia macrocephala (Bleeker)

Tilapia. (Cichlidae). Fresh waters in Senegal to Gabon. Introduced in Florida (U.S.A.). Cultivated in brackishwater ponds in Nigeria and Tanzania for experimental purposes. Male normally broods eggs and young in the mouth.

Tilapia hornorum Trewavas[1/]

Tilapia. (Cichlidae). Fresh waters of Zanzibar. Cultivated in freshwater ponds in Java and Malaysia. Introduced in U.S.A.

Tilapia leucosticta Trewavas[2/]

Tilapia. (Cichlidae). Fresh waters of western Uganda. Cultivated in ponds in Uganda and Kenya. Feeds on phytoplankton and bottom deposits formed largely from the decomposition of phytoplankton. Sexually mature at about six months age and 200 g weight. Succeeding generations mature at smaller sizes. Maternal mouth brooder.

Tilapia macrochir Boulenger[3/]

Tilapia. (Cichlidae). Fresh waters of Central Africa and Bangouelo and Moero Lakes. Cultivated in freshwater ponds in several regions of Africa. Young ones feed on zoo and phytoplankton. Above 8 cm length, feeds entirely on plankton and algae growing on larger plants. Maximum length 40 cm and weight 1.2 kg. Grows to 6–7 cm in six weeks, 14 cm and 50 g in 6 months. The rate of growth then decreases slowly, 29–22 cm and 150 g at 10–11 months, and thereafter decreases rapidly. Male grows more quickly than the female, in a proportion of 1.4:1, because of the buccal incubation by the female. Spawning occurs every 5 weeks or so in warm areas during October to March. 3 000–4 000 eggs laid by average female per year.

1/ Hybrid of T. hornorum x T. mossambica Peters or T. nilotica have given all-male F_1 generation.

2/ Hybrids of T. leucosticta x T. nigra (Günther) and T. leucosticta x T. nilotica (L.) under experimental cultivation in Uganda.

3/ Hybrid of T. macrochir x T. nilotica under experimental cultivation in Cameroon and Ivory Coast.

Tilapia marginata (Heckel)

Tilapia. (Cichlidae). Experimental cultivation in freshwater ponds in Cameroon.

Tilapia melanopleura Dumeril
Syn. T. rendalli (Boulenger)

Tilapia. (Cichlidae). Fresh waters of West Africa, from Senegal to Angola. Introduced into several countries. Cultivated in several countries of Africa, Malaysia, Vietnam, etc. Experimental cultivation in brackishwater ponds in Nigeria. The species dies at temperatures below 12-13°C and reproduces at temperatures above 21-23°C. Known to feed exclusively on plants and hence useful for biological control of weeds in fish ponds. Grows to 5-6 cm in six weeks and 14 cm and 50 g in six months. Under culture conditions grows to about 20 cm and 150 g in 10-11 months. Fecundity: 5 000-6 000. Spawns throughout the year in some areas but only four times a year in other places. Buccal incubation of eggs is not reported.

Tilapia mossambica Peters[1/]

Tilapia; Java tilapia; Mozambique mouth breeder. (Cichlidae). Fresh waters of East Africa to Natal. Introduced into several countries. Cultivated in freshwater ponds in several countries of Africa, Java, Malaysia, Philippines, Thailand, Sri Lanka, Pakistan, India, Vietnam, etc. Cultivated also in brackishwater ponds in Indonesia, Malaysia, India, Pakistan, etc. Omnivorous feeder, consuming a wide variety of plants and animals. Small fry feed mostly on plankton. Males are reported to grow quicker. Average growth to 850 g in fresh waters and 450 g in brackish waters has been reported under good farming conditions. Spawning commences from the age of two to three months. Number of spawnings per year varies with environmental conditions. In brackish waters spawning is generally inhibited. The female takes the fertilized eggs into her mouth.

Tilapia multifasciata (Günther)

Tilapia. (Cichlidae). Lake Bosumtwe (Africa). Cultivated in freshwater ponds in Cameroon, Ivory Coast, etc. Grows to about 17 cm length.

Tilapia nigra (Günther)[2/]

Tilapia. (Cichlidae). Fresh waters of Kenya and Uganda. Cultivated in freshwater ponds in Congo, Kenya, Uganda and Mozambique. Omnivorous feeder consuming algae and debris, but not higher aquatic vegetation. Maximum growth to 38 cm and 1 kg. Experimental work on monosex culture in Kenya has showed growth to be very much effected by seasonal variations in water temperature.

1/ Hybrid of T. mossambica x T. macrochir under experimental cultivation in Rhodesia.
Hybrid of T. mossambica x T. nilotica (L.) under experimental cultivation in Uganda.
Hybrid of T. mossambica x T. tholloni (Sauv.) under experimental cultivation in Germany, for behaviour studies.

2/ Hybrid of T. nigra x T. mossambica under experimental cultivation in East Africa.
Hybrid of T. nigra x T. nilotica under experimental cultivation in Uganda.
Hybrid of T. nigra x T. zilli (Gervais) under experimental cultivation in East Africa.

Tilapia nilotica (Linnaeus)[1/]

Nile tilapia; Nile mouth breeder. (Cichlidae). Galilee and Jordan to Nigeria (Nile and Senegal) in Africa. Cultivated in freshwater ponds in several regions of Africa, Israel, Thailand and Japan. Omnivorous feeder, with preference for zoo-organisms. Effective in controlling Pithophora sp. and Najas guadalupensis. At Alabama production up to 4 483 kg/ha has been obtained. Buccal incubation by female. Grows to 50 cm and 2.5 kg.

Tilapia shirana Boulenger

Tilapia. (Cichlidae). Africa and Madagascar. Experimental culture.

Tilapia sparrmani A. Smith

Tilapia; peacock cichlid. (Cichlidae). Fresh waters of southern Africa from Angola to Katanga. Cultivated in Central East Africa and South Africa (as food for black bass). Omnivorous and phytophagous. Grows to about 20 cm and 150 g. Non-buccal incubation; fry are guarded by male. Breeds at length of about 8 cm.

Tilapia tholloni (Sauvage)

Tilapia. (Cichlidae). Fresh waters of Upper Ogowe, Chiloango, Lower Congo, etc. in Africa. Cultivated in Cameroon. Grows to about 18 cm in length.

Tilapia variabilis Boulenger

Tilapia. (Cichlidae). Lake Victoria (Africa). Introduced into lakes and reservoirs in East Africa. Experimental cultivation in Lake Victoria region and East Africa. Omnivorous feeder (including algae, but not higher aquatic vegetation). Grows to 30 cm and 500 g. Buccal incubation by female.

Tilapia zilli (Gervais)[2/]
Syn. Tilapia zilli guineensis (Bleeker)

Tilapia. (Cichlidae). Lake of Galilee, Jordan, Sahara, Lower Egypt, Lakes Victoria, Rodolphe, Tchad, Nigeria and Gold Coast in Africa. Cultivated in several regions of Africa, Malaysia and Japan. Phytophagous (including higher aquatic vegetation). Substratum spawner. Breeds at about 25 cm length. The species is not a mouth breeder and the eggs placed on the substratum are guarded by the male and the female. Grows to about 35 cm and 800 g. Particularly important in the control of softer aquatic vegetation and possibly in preventing the re-establishment of infestations controlled by other means. More desirable than T. melanopleura as it is less prolific.

1/ Hybrid of T. mossambica x T. nilotica in Uganda: 100 percent males.
Hybrid of T. aurea x T. nilotica in Uganda: less than 100 percent monosex.
Hybrid of T. macrochir x T. nilotica in Cameroon and Ivory Coast: less than 100 percent monosex.
Hybrid of T. nilotica x T. nigra in Uganda: less than 100 percent monosex.
Hybrid of T. nilotica x T. mossambica: less than 100 percent monosex.
Hybrid of T. nilotica x T. macrochir in Cameroon, Ivory Coast and Gabon: less than 100 percent monosex.

2/ Hybrid of T. zilli x T. melanopleura under experimental cultivation in Uganda.

Tinca tinca (Linnaeus)

Tench. (Cyprinidae). Fresh waters of Europe and western Siberia. Introduced for cultivation in India, Indonesia, Japan and Australia, has been raised in farm ponds in California (U.S.A.). Artificial propagation in U.S.S.R. hatcheries. Feeds on diatoms, blue-green and filamentous algae, vegetable debris, molluscs, worms and insects. In Europe growth to 10-20 g, 50-100 g and 150-300 g in the first three years has been reported. In India growth up to 113 g in one year has been obtained. Spawns at 16°C or more in ponds. Fecundity: 200 000 eggs per 450 g of body weight. Considered to be suitable for cultivation along with carps, in ponds.

Tor tambroides (Bleeker)
Syn. Labeobarbus tambroides (Bleeker)

'Tambra'. (Cyprinidae). Freshwaters of Indonesia, Thailand, etc. Cultivated in ponds in Indonesia. Food: phyto and zooplankton, decayed higher plants and remnants of worms and insects. Does not breed in confined waters. Ascends rivers to lay eggs at the mouths of small tributaries, which the young subsequently ascend. Eggs 2-3 mm, reddish.

Trachinotus carolinus (Linnaeus)

Pompano; common pompano. (Carangidae). South Atlantic and Gulf coasts of U.S.A., and Brazil to Cape Cod. Experimental cultivation in the coastal areas of southern U.S.A. Able to tolerate up to freshwater conditions if the salinity is decreased gradually. Also able to withstand wide variations in pH. Temperature tolerance: 12-38°C. Food: molluscs, softer crustaceans and juveniles of fishes. Increases in length of about 25 mm per month have been reported. Mature fish move into offshore waters and spawn in areas where currents will carry the young to coastal waters. Artificial propagation by HCG injection reported to be successful. Fecundity: 400 000-600 000.

Trichogaster pectoralis (Regan)

Sepat siam; snake-skinned gourami. (Osphronemidae). Fresh waters of Thailand, Khmer and Vietnam. Introduced into several Asian countries. Cultivated in Thailand, Indonesia, Malaysia, Philippines, India, Pakistan, Sri Lanka, Japan and Hong Kong. Cage culture in Thailand. Larvae and young fry feed on plankton. Adult feed on phyto and zooplankton. Grows to 7-9 cm in three months, 10-12 cm in six months and 16-18 cm in 12 months. Matures when about seven months old. Bubble nest, about 5 cm in diameter built by the male. Fecundity: 7 000-8 000, but a nest seldom yields more than 4 000 larvae. Breeds in rice fields and in ponds with appropriate measures. Approximate production in manured ponds: 250-350 kg/ha per year.

Trichogaster trichopterus (Pallas)

Spotted gourami; sepat djawa; three-spot gourami; blue gourami. (Osphronemidae). Fresh waters of Indonesia, Malaysia, Thailand, Khmer and Vietnam. Cultivated as coarse fish and for ornamental purposes, in Vietnam. Able to tolerate slightly brackish waters. Larvae feed on phytoplankton and detritus, while fry and adults consume phyto and zooplankton, epiphytic micro-organisms and decayed algae and higher plants. Matures when about three months old. Male fish builds a floating nest from pieces of plants joined together with foam bubbles. Spawns every month.

Tylochromis lateralis (Dumeril)
Syn. Chromis lateralis (Dumeril)

(Cichlidae). Fresh waters of Senegal (Africa). Experimental cultivation in Zaire.

Vimba vimba (Linnaeus)

Vimba; 'syrt'. (Cyprinidae). Fresh waters in basins of North and Baltic Seas from the Elbe river in the east and basins of Black and Caspian Seas. Cultivated in middle and southern states of U.S.S.R. and Poland. Semi-migratory species. Young ones feed on planktonic crustaceans and adults on benthic invertebrates like molluscs, worms, insects, etc. During spring enters rivers, with mature eggs in order to spawn. Spawning takes place in June and July. Very sensitive to purity of water. When water is turbid, spawning is halted and the eggs and larvae die. Fecundity low. No parental care. Existence of 'homing instinct' indicated. Attains length of about 35 cm.

Wallago attu (Schneider)

Freshwater 'shark'. (Siluridae). Freshwater river fish in India, Pakistan, Burma, Thailand, Indonesia, Vietnam, Khmer and Sri Lanka. Cultivated in confined waters like reservoirs, swamps, marshes, etc. in India, Pakistan and Burma. Extremely voracious carnivore. Fry feed on fishes, insects, crustaceans, and algae. Adults feed almost exclusively on aquatic animals, chiefly fish. Spawns during monsoons in inundated marginal areas of rivers. Grows to lengths over 50 cm. Not suitable for cultivation in ponds.

11. AMPHIBIA

Rana aurora Baird & Girard

Western bull frog; red-legged frog. (Ranidae). U.S.A. and Canada. Cultivated in Pacific coast states of U.S.A. Generally grows to 6-12 or 13 cm in length.

Rana boylei Baird

Yellow-legged frog. (Ranidae). U.S.A. Cultivated in California and Oregon states. Grows to 6-9 cm in length.

Rana catesbeiana Shaw

Bull frog. (Ranidae). U.S.A., Canada and Mexico. Cultivated in U.S.A. Largest North American species of the genus. Maximum length: 20 cm. In stocking ponds with breeders, sexes should be nearly equal in number, as one male usually pairs with one female during a season. Growth rate varies with climatic conditions.

Rana clamitans Latreille

Green frog. (Ranidae). Eastern U.S.A.; introduced into Canada. Cultivated in some states of U.S.A. Grows to 9-10 cm length.

Rana grylio Stejneger

Southern frog. (Ranidae). U.S.A. Cultivated in Florida and other southern states of U.S.A. Grows to 13-15 cm length.

Rana hexadactyla Lesson

Indian green frog. (Ranidae). India. Experimental cultivation in Indian farms. Bred by administration of pituitary hormone. Frog-cum-fish culture, with this species, indicated as a result of experimentation. West Bengal race of the species reported to be phytophagous and southern race, carnivorous.

Rana palustris Le Conte

Pickerel frog. (Ranidae). U.S.A. and Canada. Cultivated in central and northern states of U.S.A. Grows to 8–9 cm length.

Rana pipiens Schreber

Leopard frog. (Ranidae). U.S.A., Canada and Mexico. Cultivated in eastern states of U.S.A. Grows to 9–10 cm length.

Rana tigrina Daudin

Indian frog. (Ranidae). India. Experimental cultivation in Indian farms. Successfully bred with pituitary hormone injection. Frog-cum-fish culture indicated using this species. Carnivorous. Semi-aquatic and migratory species.

12. REPTILIA

Chelydra serpentina Linnaeus

Snapping turtle. (Chelydridae). Fresh waters of eastern and central North America. Reported to be cultivated in Japan. Very fierce and may leave waters for certain periods. Edible.

Malaclemya terrapin centrata (Latreille)

Southern diamond-back terrapin. (Emydidae). Carolina to Florida in U.S.A. Hatcheries have been established in Chesapeake Bay region. Adults feed on fish and crabs, and young ones on fish and oysters.

Malaclemys terrapin littoralis Hay

Texas diamond-back terrapin. (Emydidae). Along coast of Texas and southward in U.S.A. Details same as M. terrapin centrata.

Malaclemys terrapin terrapin (Schoepff)

Northern diamond-back terrapin. (Emydidae). U.S.A. Extensively eaten in U.S.A. and bred in terrapin farms.

Trionyx sinensis Wiegmann
Syn. Amyda sinensis Wiegmann

Soft-shell turtle. (Trionychidae). Rivers and muddy bottoms of shallow waters in China. Cultivated in ponds in China (Taiwan). Production reported to be about 300 kg per year. Carnivorous and voracious species.

13. MAMMALIA

Myocastor coypus (Molina)

Nutria; coypu. (Capromyidae). Native of temperate parts of South America; introduced into various parts of U.S.A. and established in many states. Cultivated in fresh waters in Israel, Poland, Cameroon, etc. for control of weeds and as food. Also provides manure in pond. This large South American aquatic rodent shows considerable promise as biological weed control agent in fishery waters.

Trichechus manatus manatus Linnaeus
Syn. Manatus manatus (Linnaeus)

Manatee; West Indian manatee. (Trichechidae). Coast and coastal rivers of West Indies and adjacent waters and southeast coast of U.S.A. to northern South America. Cultivated in reservoirs in British Guiana to clear weeds. Voracious grass feeder. Perfectly docile, easily bruised and seemingly very slow in reproduction. Can easily be drowned. Harmless to fishes and other aquatic animals. Average length: about 215 cm. Females give birth to single calf. Gestation period: about six months.

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